An Outbreak Of Bovine Leptospirosis In Virginia

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REPORTS[1-6,8] of the occurrence of bovine leptospirosis in various states have appeared in the past several years. Sippel, Boyer, and Chambers[7] recently reported the first proved diagnosis of leptospirosis in cattle in southeastern United States. It is the purpose of this paper to describe an outbreak in a dairy herd in Virginia and to report the isolation of *Leptospira pomona* from the herd. As far as the authors are aware, this is the first account of the isolation of this organism from cattle in Virginia.

History of Outbreak

In early July 1952, two of the authors (W.B.B. and A.W.R.) were consulted by the owner of a dairy herd in which abortions had been occurring since June 22. In addition, two heifers were found dead on June 30. One had aborted her calf shortly before her death, and the other had had an incomplete abortion. The owner stated that he had observed no symptoms in these two cows prior to the abortions and death. Most of the affected cows were still in milk production which dropped for a few days after the abortion. No other ill effects were observed.

Examination of the herd revealed little evidence of the nature of the trouble. At the time of the first examination there were no animals exhibiting visible symptoms. The following history of the herd was obtained.

Twenty-four purebred and grade Holstein cows and heifers had been bred in the fall of 1951. Breeding was done by means of artificial insemination through the local artificial breeding association. A young bull that had been raised on the farm was used. The herd was brucellosis-free; the last negative test had been on March 14, 1952. Only two additions from other herds had been made in recent years. One of these, a bull calf, was acquired in the fall of 1951, and the other, a heifer calf, was purchased in March 1952. The herd was pastured in two groups, one consisting of the cows in milk production and the other of the dry cows and bred heifers. The first group was receiving a supplementary grain ration. Both groups were watered from a stream that had its origin on the farm and ran through the pastures. Abortions had occurred in both groups and had occurred in animals that had been bred by artificial insemination and by the bull. Prof. A. B. Massey, Biology Department, Virginia Polytechnic Institute, who assisted in the examination of the premises, identified poison hemlock along the stream which ran through the pastures. Some of the plants had been eaten, but whether this had any significance in the death of the two heifers could not be determined.

One of the authors (A.W.R.) was called subsequently to treat a sick cow in the herd. This cow had a temperature of 105 F., refused to eat, was down in milk production, and was sensitive to palpation over the abdomen. Rapid recovery followed the administration of antibiotics, and she delivered a normal calf 21 days later. Another call was made to remove a dead calf from one other cow that had

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trouble in delivering it. This particular animal showed no other symptoms.

Examination of the herd approximately four months after the first loss revealed that, of the 24 bred cows and heifers, nine had aborted during the seventh and eighth months of gestation. The losses had occurred during a 38-day period. With the exception of one cow, no symptoms other than abortion and the subsequent temporary drop in milk production were observed.

Laboratory Examinations

Blood samples were collected at the beginning of the investigation from several cows that had aborted. All were negative for brucellosis. Four samples, submitted to Lt. Col. R. H. Yager and Maj. W. S. Gochenour, Jr., Veterinary Division, Army Medical Service Graduate School, were positive for Leptospira. Two of the samples had an agglutination-lysis titer of greater than 1:6,400, one a titer of 1:6,400, and one a titer of 1:1,600 for *L. pomona.*

Two fetuses were made available for examination. Both showed some subcutaneous hemorrhage and slight icterus of the tissues. Attempts to isolate pathogenic organisms by cultural methods and by inoculation of fetal tissues into young hamsters and guinea pigs were unsuccessful.

After the results of the serological tests were known, a urine specimen was obtained from each of six cows that had aborted and from the one that had shown clinical symptoms. These specimens were obtained 28 days after the first abortion had occurred and 11 days later in the case of the cow presenting symptoms. Each urine sample was injected into two young hamsters. Blood obtained from the hamsters by cardiac puncture on the fourth day was inoculated into Noguchi-Wenyon medium. Five days after incubation at 30 C., one tube showed growth of an organism that was morphologically indistinguishable from Leptospira on dark-field examination. This organisms was successfully subcultured and also passed through young guinea pigs. A culture submitted to Lt. Col. R. H. Yager and Maj. W. S. Gochenour, Jr., for typing was identified as *L. pomona.*

Summary

An outbreak of leptospirosis in a dairy herd in which abortion in the seventh and eighth months of gestation was the dominant symptom is described. Recovery of *L. pomona* from the herd is reported.

Acknowledgments

The authors wish to express appreciation to Prof. A. B. Massey, Biology Department, Virginia Polytechnic Institute, for his assistance in the examination of the pastures; to Lt. Col. R. H. Yager and Maj. W. S. Gochenour, Jr., Veterinary Division, Army Medical Service Graduate School, for the serological tests and typing the organism; and to W. L. Threlkeld, Jr., for laboratory assistance.

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Glycerin in Treatment of Pregnancy Toxemia in Ewes

Wyn. R. Griffiths, F.R.C.V.S., Newport, Mon. (England), reports (*Vet. Rec.*, Nov. 15, 1952) that 12 ewes affected with pregnancy toxemia were treated by oral administration of two 4 oz. doses of glycerol (glycerin) mixed with an equal quantity of water to which chloradyne was added. In one flock, 11 out of 12 cases, and in another flock, three of four cases, recovered. Some ewes were treated a second time as indicated.

In the November 22 issue of the same publication, another veterinarian, H. Forsyth, Lochlade, reports trying the glycerol treatment in 2 oz. doses twice daily for three days. He reported that, while the treatment was not spectacular, it was definitely superior to other methods. Any ewe which was unable to lie on her brisket and keep her head up died in spite of treatment.

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Relation Of Farm Dairy Housing To Animal Health†

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Consideration of animal health in the design of facilities for housing animals has been given little attention in the past. Architects of farm buildings have been governed primarily by matters pertaining to efficiency and economy.

In this article, the authors critically survey some common practices in housing dairy cattle and suggest devices and methods to prevent injuries that result directly from improper design and construction. Features of design need revaluation in the light of the maintenance of healthy animals in comfortable quarters for the production of increased quantities of high quality, wholesome milk.

MODERN dairy cattle are, as a result of man's influence, decidedly artificial creatures. Through continued selection, primarily for ability to convert large quantities of grain and roughage into milk and butterfat, animals have been developed that are abnormal. There is little similarity between such cows and early ancestors that produced only enough milk to feed their calves for a few months.

Today, dairy cows are expected not only to produce large quantities of milk but also to conceive and reproduce, dropping a calf every 12 to 13 months. Furthermore, these modern animals start their lives as calves that are permitted to remain with their dams for a period of only one to three days. They are then fed from a bucket twice daily, rarely three times daily. Unless these calves are reared in buildings or pens that are so located, arranged, and constructed to promote sanitation and health there is little chance of growing healthy heifers into high producing cows.

Adequate Calf Housing

On many otherwise well managed and operated dairy farms, calves are all too frequently much neglected. It is not surprising therefore, that mortality averages about 20% and morbidity considerably higher. An important cause of death is the scours-pneumonia complex. While infectious agents are generally considered to be the primary cause of the condition, predisposing factors are also important. Among these are improper feeding and improper housing.

The newborn of all species of domestic animals are quite susceptible to sudden changes in atmospheric temperature. The same is true for humidity and drafts. Proper location, arrangement and construction of buildings can largely control these factors.

The agricultural engineer in planning and designing such buildings must consider to some extent the different sections of the country with their variations in climate and soil conditions, the type of housing used for producing herds and the conservation of time and energy in caring for young stock. Costs of materials and of construction are also extremely important.

Fig. 1. Individual pens for young calves at the University of Missouri. Note the solid panels on three sides for protection against drafts. Pens can be cleaned easily.

Location for calf raising in relation to the area occupied by older animals may be important from the standpoint of warmth in winter. It may also be important in causing fluctuations in temperature, especially if the cows are in the barn for feeding and milking and then are moved to the outside. Transmission of diseases and parasites may also be affected through proximity to adult cattle.

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If calves are to be housed in the same building with older cattle they should be in a part of the barn that can be reached by direct sunlight and protected from drafts. Individual pens, as shown in figure 1, are preferable when the calf is first removed from the dam and until it reaches its second or third week. It is best to build such pens with solid partitions on three sides; drafts are reduced and spread of disease by direct contact prevented.

Floors may be of a variety of materials and types of construction. Concrete that is properly insulated is satisfactory if kept well bedded. Too frequently the concrete is poured directly on the ground with improper insulation and with an inadequate moisture barrier. Such floors are invariably wet and cold. In addition, calf barns or dairy barns are frequently poorly located from the standpoint of surface drainage.

Fig. 2. Individual calf pen with raised slat floor.

Slatted wood (fig. 2) or one inch welded wire supported on a substantial frame that is elevated 18 to 24 inches makes satisfactory floors for calf pens. Ease of cleaning and disinfecting is important.

Calves may be housed in pens that will accommodate several, if consideration is given to uniformity of age. It is not advisable to pen newly born calves together if there is an age spread of over three weeks. As the calves reach three weeks of age they can be placed with those up to six weeks of age. Those from six weeks to nine weeks of age can be penned together. After animals reach the ninth week there is not the same danger of spreading infection and a somewhat greater variation in ages is permissible.

Pens that accommodate several animals should have stanchions in which to confine calves during and after feeding of milk. This will prevent them from sucking one another. Poorly balanced and misshaped, as well as infected udders can result if calves are permitted to suck one another after being fed milk.

Figure 3 illustrates a cutaway perspective of a calf and young stock building designed by J. C. Wooley, agricultural engineer, at the Missouri station. Such a building will adequately house the young stock produced in a 20 to 30 cow dairy herd, if calving is distributed throughout the year.

Three individual pens for baby calves are located in the south end of the building. Outside runs are available to each pen. These small runs should be kept free of vegetation to aid in control of internal parasites. Infective larvae of most of the small roundworms of ruminants establish themselves on vegetation and are ingested by the host while grazing.

Sliding doors can be raised in fair weather, permitting the calves to use the pens, thus providing space for exercise and exposure to sunshine. When the doors are up they shield the windows which are immediately above. This shades the inside pen, which may be desirable in summer. Calves may be left in the individual pens for three to four weeks, depending on the calving schedule. Both inside pens and outside runs are built with solid partitions for maximum protection against drafts. The floor may be constructed as elevated slat type or with a wire mesh.

From the individual pen the calves may be moved after three weeks to the small group pen. This is also located at the south end and has an outside pen on the south side of the building. Small stanchions have been placed in this group pen for securing the calves during and following feeding.

The center part of the building has been designed for near yearling and older heifers that are being raised for replacements. These two pens can be made into one or separated as desired. Both pens open into lots on the sides of the building. The winter lot would be on the east side. During the summer the heifers would have access to a pasture on the west side.

Three maternity stalls have been placed in the north end of the building. They are separated from the calf and young stock part of the building by a solid partition that extends to the ceiling.

An effective and economical system of raising healthy dairy calves has been developed at the Regional Animal Disease Research Laboratory of the U. S. Bureau of Animal Industry.

This laboratory located at Auburn, Ala., is conducting research on bovine coccidiosis and internal parasites of cattle. Healthy parasite-free calves are needed for experimental use, as they are essential for good herd replacements.

Portable Calf Pens

Portable individual pens five feet wide by ten feet long are used (fig. 4). They are constructed of a wooden frame to which is attached one by four inch mesh welded woven wire 36 inches high. One end of the pen is covered by a removable sheet aluminum top that is nailed to a light wooden frame. For added protection in cold weather, the covered end is enclosed by removable wooden panels. Heavy building paper can be substituted for the wooden panels. Burlap can be draped over the open end of the shelter in extremely cold weather. Each pen is equipped with a combination covered hay and grain rack and a water bucket which are suspended from the top rail. Bedding is used in the covered end.

An ideal location for a battery of these pens is on a shaded slope near the dairy barn. Pens are placed at the foot of the slope and moved up the slope in a zig-zag manner; each is moved every seventh day. Thus each occupies a clean space each week. Two men can easily move the pen, without disturbing the calf.

Construction to Prevent Injuries

The statement has been made[1] that, "only healthy cows produce milk of good quality". Cows, to be healthy, must be free from injuries. Besides good quality milk, the dairyman is interested in high production. Top production can not be attained, unless cows are healthy, free from injuries, and completely comfortable.

Many injuries suffered are related either directly or indirectly to the inadequacy of buildings and equipment. Such injuries may not affect the quality of the milk, from the standpoint of human consumption, as do various diseases such as brucellosis or tuberculosis. Mastitis, which often follows injury to the udder, may be an exception. Mastitis lowers production, causes difficulty in various manufacturing processes and makes the milk unpalatable and unsafe for human consumption. In advanced stages, it causes milk to appear bloody, stringy, flaky, or thin and watery. In milder cases, although the appearance may not be changed, the milk may have a salty taste and an undesirable odor.

Udder and teat injuries, stiffness and lameness, injured knees and hocks, all may cause lags in milk production or may be severe enough to have a lasting effect on the animal.

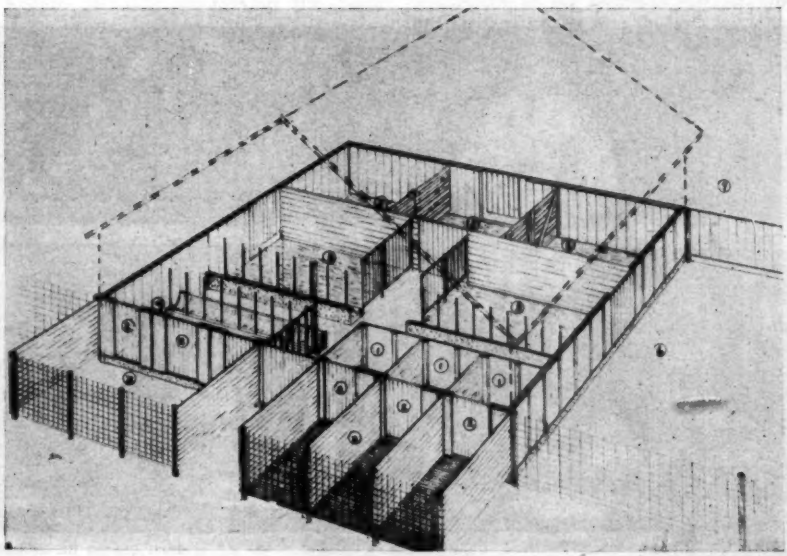

Fig. 3. A separate young-stock barn. Note separate calf pens adjacent to south end with outside run-pens. When doors are opened over window, shade is provided inside.

These can practically all be eliminated with adequate shelter and equipment.

The predominant cause of these injuries has been and still is, inadequately designed and constructed stanchions and platforms in the conventional stanchion-type dairy barn. For the last 50 years or more dairy barns have been constructed with a nearly standard cow stall having a platform 38 to 44 inches wide and 60 to 66 inches long. Figure 5 shows a group of Holstein cows lying on a 62 inch platform which is the recommended[8] length for medium sized Holstein cows. These cows may be slightly larger than medium, whatever that may be, however it is apparent that this platform is far from adequate for their purpose.

Conventional Stall Platforms in Dairy Barns not Comfortable

Little thought has been given to the comfort of the individual cows in the past. Most dairy barns were constructed with one standard length of stall platform, which was supposed to accommodate all the cows of one herd. No herd of milk animals, however, is of one uniform size and adaptable to one given length of platform. To improve the cow's comfort and reduce injuries, bridging the gutter may be used as a temporary expedient. The situation may be further improved with a chain-tie stanchion substituted for the conventional type. The chain-tie allows greater freedom in movement fore and aft in lying down and moving about in the stall.

From the standpoint of sanitation, short cows are not adapted to long platforms, with the result that the litter is constantly wet and dirty. In moisture evaporation studies of dairy barn floor surfaces, in the Psychroenergetic Laboratory at Columbia, Mo.,[8] it was found that the proportional amounts of evaporation from the bedding was from nine to 13% higher for Jerseys than for Holsteins when they were both confined in standard 48 by 68 inch stalls. This indicates that the Jerseys, being a shorter and smaller cow and not adapted to the standard platform length, deposited a higher proportion of urine and feces in the bedding. This situation causes dirty cows and in general unsanitary conditions. More bedding and more labor are required to maintain any degree of sanitation. Milk sediment tests and bacteria counts will no doubt indicate an undesirable situation.

Concrete platforms of these conventionally designed stalls are particularly uncomfortable in themselves. They are hard and cold due to the nature of concrete. The flat smooth design of the platform, with some slope to the gutter for drainage, makes it quite difficult to keep it adequately bedded. Cold floors are conducive to mastitis and lameness. The udder,

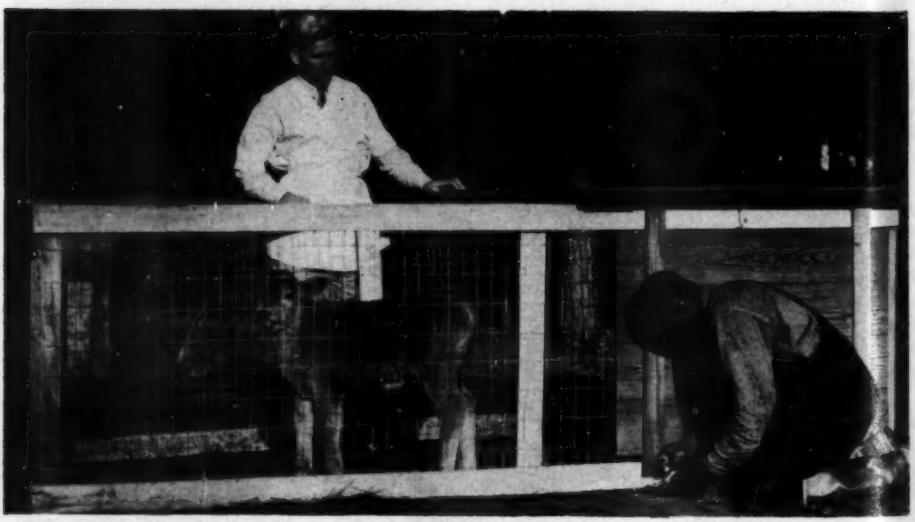

Photo Courtesy Dr. Leonard R. Davis

Fig. 4. Portable calf pen used in Alabama experiments in studies on the control of bovine coccidiosis. The simply constructed enclosure is 10 ft. long, 5 ft. wide, and 3 ft. high. Panels provide shelter during inclement weather. Note feed and water containers.

being directly on the cold concrete, is exposed to chilling and drafts and to injury by adjacent cows. Even though the platforms are long enough, observations reveal that in many cases the cow must lie in an awkward position which leaves the udder unnaturally exposed.

Much consideration has been given to the adaptation of the cow to a given platform and stanchion. Various types of trainers and gadgets have been devised to train animals not to stand in the gutter, although from a comfort

Fig. 5. Cows lying down on a conventional type stanchion barn on a 62-inch stall platform. Note crowded condition and cow's udder showing over edge of gutter.

standpoint that must be the natural place for them to stand. Spacers have been devised to keep the cows from crowding and injuring one another. These methods have been attempted cures without actually diagnosing the basic cause of the trouble. At best it is asking quite a bit of a cow, with the best designed platform and gutter, to at all times deposit the fecal matter and urine directly into the gutter, not on the stall platform nor on the alley floor behind, and never to stand in the gutter nor hang over into it when lying down. It is the writer's contention that new shelter and equipment should be adjustable or adaptable to the cow rather than later attempting to fit the animal to the equipment which has been constructed in a non-flexible manner.

If dairy cows are to be confined in stanchion-type barns, everything possible should be done to make them comfortable and to keep them free from injuries. The so-called "comfort-stall" has been used successfully in many instances. Figure 6 shows the interior of a comfort-stall dairy barn on the Wood Ford Farm in Connecticut. Note the four-inch retainer curbs for the bedding. The stalls are 48 by 75 inches and the rear retainer curb is adjustable to the individual cows. Floors are insulated and the curbs retain a thick dry litter under the animals. The stanchions are chain-tie for maximum freedom. This allows the cows to move forward in lying down and so be completely on the curbed portion of the platform. In this 100-cow herd no swollen hocks or knees or udder injuries were reported during the first year that the equipment was used.

Prof. Joe Nageotte, of Pennsylvania State College, has designed a somewhat more elaborate comfort-stall. It has the retainer curb for litter which is adjustable fore and aft. Pipe partitions extend back within 16 inches of the gutter between each cow. It has a chain tie. The grain and hay mangers are suspended on rods projecting from the stall partitions making them also adjustable fore and aft.

Loose Housing Economical

It should be remembered that any added equipment to the conventional stanchion-type barn increases the already high housing investment for the dairy herd. The majority of dairy farmers are interested in an economical, functional, and simplified type of housing for their dairy enterprise. Loose housing fills these requirements besides being very advantageous from the standpoint of general animal health and in the elimination of injuries.

A three-year summary, 1946-49,[4] on herd health at the University of Wisconsin for the research project on The Comparative Results of Stanchion Barn *vs.* Open Loose Housing

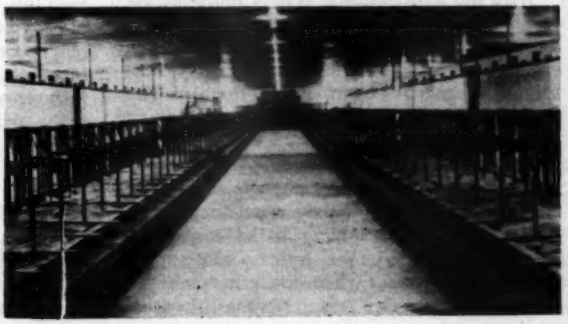

Fig. 6. Comfort-stall dairy barn in Connecticut. Note retainer curbs for bedding and the chain-tie stanchions. Stalls are 4 ft. x 6 ft. 3 in. No swollen hocks, knees, or udder injuries occurred during the first winter of use.

Barn, reports the following observations. The number of cows affected by stiffness and lameness, injured knees and hocks, and stepped on teats amounted to 40 in the conventional stanchion barn against none in the uninsulated loose housing barn. Seventeen of the cases caused noticeable production lags and 12 were considered to be injuries having a lasting effect on the animals.

Fig. 7. Cow lying on a typically bedded area in the loafing barn of a loose-housing type shelter. Note, no udder showing. Solid comfort.

Observations were similar at a research project[5] in Idaho at the Caldwell Branch station. In this study 18 paired cows were observed, nine in the stanchion barn and nine in the open shed. Cases of injuries, stiffness, bruised knees and hocks, and cows off-feed occurred almost seven times more often in the stanchion-barn group than in the open-shed groups for the two winters of 1948 to 1950. The cases in the stanchion-barn were 34 as compared to five in the open shed. In observing sanitation conditions they also found that cows on concrete surfaced lots produced milk with less sediment by a significant amount and their udders were significantly cleaner than those in unsurfaced lots or in the stanchion barn.

With the loose-housing system there are certain requirements that must be met as is true with any system. One of the most important of these is adequate space. Utah State Agricultural College[6] at Logan, found that for Holstein cows shed area of 40 square feet per animal was inadequate and 75 square feet was more than necessary. Three per cent more bedding was required for the 40 square feet allotment per cow and they were not as clean as those using less bedding in the larger area. During the experiment four quarters were treated for mastitis when the cows were restricted to 40 square feet. No mastitis developed when the allotment was 75 square feet.

Housing of dairy cattle is important in producing and maintaining healthy individuals that make up the herd. This is largely the result of demands for rapid development and heavy production. Consideration must be given to location, ease of cleaning, arrangement, cost of materials, and cost of construction to provide sanitation and comfort. Only healthy cows maintained in such surroundings will produce high quality and wholesome milk for human consumption.

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Facilities of the aftosa (foot-and-mouth disease) laboratory built at Palo Alto, Mexico, a suburb of Mexico City, about six years ago, are now being utilized for poliomyelitis and other virus research.—*U.P., Jan. 10, 1953.*

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Actinobacillosis appears to be widespread in Colorado and of increasing importance as a disease problem. It occurs in cattle in both feed-lots and on the range. Economic losses due to liver condemnations on slaughter have reached serious proportions and are estimated to be as high as 20%. Sulfonamides injected intravenously have proved efficacy if used early and before extensive tissue destruction occurs.—*Harry Johnson, D.V.M.*

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One of the problems some practitioners appear to handle awkwardly is acceptance of the new graduate, who locates in the community, as a colleague rather than as a competitor.—*O. H. Meineche, D.V.M.*

Bleeding In Race Horses: A New Way To Control It

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AS a veterinarian at one of the Ohio race courses (Ascot Park), the writer was especially concerned with the unusually high prevalence of epistaxis among the 800-odd horses which had run there during the previous season.

While hemorrhage from terminal blood vessels is not a major turf problem, it is nevertheless common to all tracks. By incapacitating a horse from running well, sometimes even from running at all, it can prove costly indeed both to the owner and to the betting public.

Such hemorrhages, notably nosebleed or epistaxis, are attributed to a variety of factors. Humid, muggy weather is a probable cause. Horses are more apt to bleed at tracks situated near sea level locations than those located above sea level. It is likely too, that hemorrhages are induced by indiscriminate use of heart stimulants, hormones, and concentrated vitamin preparations which, legal or not, are sometimes injected into horses the day they are to race in the belief that such injections increase speed. Since they actually do increase blood pressure, the danger of hemorrhage is correspondingly increased.

Whatever the cause of such hemorrhagic disorders, there was urgent need at Ascot Park this past year for an effective coagulant which would be both prompt in action and safe. Because it has been successfully used for several years in human medicine to check abnormal, venous, and capillary bleeding, koagamin®, a sterile, aqueous solution of oxalic and malonic acids was tried. Oxalic and malonic acids are active principles of Shepherd's Purse, a widely distributed weed valued from ancient times for its bloodclotting properties. Koagamin at once produced excellent results. The writer was not aware that this coagulant had ever been used on race-horses but since using the product it has been learned that it is now being administered with good effect at two of the tracks in Cleveland, and that it is being tried out at various other courses in the South and Midwest.

During the recent season in Akron koagamin was used 71 times. Success with the preparation was constant; all of the horses treated returned to the track, their bleeding controlled, and several of them winning not once but several times thereafter.

After considerable experiment the procedure found most satisfactory was as follows: A 10 cc. injection (intramuscular) was given the day before a race and another 10 cc. injection (intravenous) two hours or so prior to it. The following reports include representative case histories.

Case Reports

Case 1. This 12-year-old chestnut horse was the first patient treated with koagamin. Because of epistaxis, this animal had not raced with any success for two years. It was treated the day before and the day of the race, ran well and came back sound. The next time out, the horse won on a heavy track. This animal has been treated 12 separate times; since the first treatment no bleeding has been observed.

Case 2. The second horse treated, a six-year-old, was a constant bleeder and had failed dismally on the Chicago tracks. With only one dose of koagamin intravenously, administered the day raced, this horse won its first Akron race and reached the finish line in normal condition. It has been treated five times in all; has had two wins and a second. All bleeding has stopped since the first treatment.

Case 3. This five-year-old chestnut gelding was treated five times, with only one injection the day of the race. The horse has won once and although formerly a confirmed bleeder, now invariably finishes sound. There is no bleeding upon return to the stables.

Case 4. For each of five races, this three-year-old bay colt received only one injection, this being on the day of racing. The colt won the second and fifth races in which it was entered. After the first treatment, bleeding did not recur.

Case 5. After trying many things to stop bleeding in this three-year-old chestnut filly, the trainer presented the animal for treatment. One injection was given an hour before post time. She lost a close race. Bleeding was completely controlled. This filly won her second race easily. In eight starts she won three

®Chatham Pharmaceuticals, Inc., Newark, N. J.

times, was second twice, and third once.

Case 6. This nine-year-old chestnut gelding bled the first time on the Akron track. At the time of the next entry, one injection was administered. Although not a winner, the animal came in sound.

Case 7. This was a nervous Thoroughbred mare in which injury in thrashing around in the stall was followed by severe epistaxis. When the writer was called in, the stall was covered with blood; bleeding was profuse. Bleeding stopped in half an hour after injection of 10 cc. of koagamin intravenously. It was completely arrested when the second dose, also intravenously, was given two hours later.

Case 8. Because a five-year-old mare was such a bad bleeder, entry had been refused at a race track in another state. The mare was shipped to Ascot Park track for the purpose of trying the treatment. General condition was poor, but after a few days rest, 10 cc. of koagamin were given intravenously. The trainer was instructed to work her one hour later. She breezed ⅝ of a mile handily in 36 seconds. The second day after that workout, she raced seven furlongs in 1.27 2/5 and won easily. No bleeding occurred during the race nor afterward while being cooled out.

The concurrent use of another drug might counteract the desired action of koagamin, a fact which appears to have been pretty well illustrated by this same mare. The next time raced, treatment as outlined above was given. After running a ½ mile, bleeding was such that she had to be pulled up by the jockey. At first the writer was puzzled and then learned that the trainer had given a concentrated vitamin preparation after treatment with the coagulant. Under the circumstances, the writer disclaimed any further responsibility and withdrew from the case, but several weeks later agreed to treat this mare provided nothing else was given. She has worked ⅝ of a mile on two occasions and ¾ mile once. All three workouts were in exceptionally good time. Now she is ready to race.

On a bad, rainy day later and a muddy track, this mare won a 6½ furlong race in the exceptional time of one minute and 21 2/5 seconds. She won it easily and at no time were any signs of bleeding apparent. This case convinced the writer that koagamin is nearly 100% positive in the treatment of epistaxis in race horses.

In none of the foregoing were there any side reactions whatever, the preparation being free from toxic elements and proteins. Just what koagamin's specific mechanism is has not yet been conclusively established. It has been suggested, however, that its two component dicarboxylic acids mobilize prothrombin by releasing it from combination with calcium and thus enabling it to be converted into thrombin for rapid coagulation[1].

Although this coagulant became an effective tool of the veterinarian only within the last decade or so, it has held an established position in human medicine for many years. Page and his associates,[2] for instance, as well as Stapleton[3] and Quick[4] all affirm that oxalic acid, one component (closely related malonic acid being the other) is a highly effective clotting agent alone. McGavack[5] then reported that clotting time was shortened by koagamin injections in four of his patients, effects of which lasted up to four hours. This observer concludes by writing that "dicarboxylic acid compounds (*e.g.* koagamin) at the present time seem to offer the most hopeful solutions to the problems involved in the management of the actively bleeding case."

The drug's subsequent use in veterinary medicine, and most recently in race-horse therapy, was further validated by research workers who, although still limiting their observations to man, found the agent prophylactically effective in preoperative conditioning[6,7,8,9,10,11] and in the prevention of postpartum hemorrhage[12,13,14]. In its preveterinary use, moreover, koagamin was discovered to control profuse hemorrhages (uterine bleeding,[14] hematemesis, gastric, and duodenal ulcers,[15] epistaxis,[6] wounds and hemoptysis[16,17]. Hemophilia, too, was included in its therapeutic range[2,5].

Use in Small Animals

To provide a still more solid basis for the recent choice of this preparation in managing the racing bleeders, it is noted the coagulant has an impressive record for hemorrhage control in small animals.

Blamey,[18] for example, found it especially effective in treatment of dogs extensively poisoned by a chemical which, employed to facilitate the removal of ice and snow, caused internal hemorrhages with resulting bloody stools and vomiting. He also found it useful in postpartum hemorrhage and in hemorrhages following the multiple extraction of teeth in old dogs. Similarly Klausman and Brown reported as recently as last June that with koagamin injections they had saved the lives of 47 dogs poisoned by warfarin, a hemorrhage-producing rat-bane. After injecting 2 cc. of the preparation into a dog which presumably

suffered likewise from warfarin poisoning, Bircher[21] was prompted to report that "in 20 years of practice, I have never seen a dog that had vomited blood from the mouth and passed blood from the rectum for over 24 hours in such quantity, recover."

In a recent private communication, Dr. John R. McCoy, former clinical director of the Raritan Animal Hospital, Stelton, N. J., now engaged in canine cancer research, reported that in one year he had used koagamin, with success each time, on approximately 300 dogs and other household pets. Observing in particular that it facilitated wound healing, McCoy agrees in the recommendation that it be initial and routine treatment for hemorrhagic conditions in small animals. He found it especially valuable as a check for oozing blood, that is, blood escaping through medium and small calibre collateral vessels after ligation of major arteries and veins, and added it to the routine preoperative procedures.

Because of these and other background facts it would seem, in conclusion, that koagamin treatment of bleeding race horses represents not so much an innovation as it does a logical veterinary development. If the di-acid coagulant should prove to work as effectively at other tracks as it has at the one in Akron then it must be accepted as the final solution for one of the turf's oldest and, when it occurs, one of its most disturbing problems.

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Infectious Atrophic Rhinitis Unrelated to Swine Erysipelas†

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H. L. Messmore, in an article on erysipelas of swine, concluded that ". . . . so-called infectious atrophic rhinitis is a manifestation of erysipelas . . . . ."[1] and ". . . . . rhinitis and so-called infectious atrophic rhinitis of pigs appear to be coexistent with erysipelas in my practice."[2] This prompted an investigation by the writer to determine if *Erysipelothrix rhusiopathiae* (Migula) Winslow, *et al.*, is the causative agent or possibly a synergist with other organisms in causing infectious atrophic rhinitis.

Sixteen pigs, from four different herds, positive for infectious atrophic rhinitis on postmortem examination, were used in the following experiment.

On postmortem examination the remaining turbinates were removed as aseptically as possible from the head of each infected pig. Turbinates were ground in a sterile mortar and pestle. A suspension of the ground product was made by adding 5 ml. of sterile Ringer's solution.

Turbinate suspensions from 12 pigs were stored for 18 days in a freezer cabinet at —2 C. while that from four pigs was used immediately for the experiment. Gwatkin, *et al.*,[3] found that infectious atrophic rhinitis materials remained active for four months when stored in the frozen condition.

Since pigeons are susceptible to *E. rhusiopathiae* and the infection proves fatal to them within 96 hours, 1 ml. of the suspension from each pig was inoculated separately into pigeons intramuscularly to determine if that organism was present.

The birds continued to live, eat, and appear in good health. Twenty-one days later they were inoculated intramuscularly with 1 ml. of a suspension in Ringer's solution of *E. rhusio-*

(Continued on page 101)

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Enteritis And Dysentery In Garbage Fed Swine: A Clinical Report

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IT has been the custom to anticipate and treat sporadic epizootics of acute catarrhal enteritis in swine. These outbreaks usually are seen on those farms where the swine are fed a diet consisting of uncooked street garbage. The most frequently observed type of diarrhea is noninfectious and is due both to poor management and to this method of feeding.

The first example is seen during the late fall and winter when the ration of garbage is picked up frozen in the morning by the swine feeder and is fed to the animals in the afternoon. Another form of enteritis that may occur at any time of the year is due to contamination of the garbage with the irritating chemical disinfectants used by the housewife in cleaning garbage disposal cans.

The etiologic agent will produce in either event, a noncontagious, acute, catarrhal enteritis in pigs of any age or size in scattered pens when these animals consume an excessive amount of the toxic material. It is believed that the signs of rapid dehydration, toxemia, weakness, and death are due to an interference with the absorption of nutrients and to the increased peristalsis causing the diarrhea. Pneumonic complications frequently accompany the primary condition in winter or during rainy cold days in the fall.

Postmortem Lesions

Postmortem examinations of animals show an uneven spreading of hyperemia throughout the gastrointestinal tract. Most of this hyperemia, which, as a rule, also is most severe in this area, is observed in the cephalic part of the gut when the etiological agent is caustic in nature. A heavy coat of mucus is observed on mucous membranes. There is some swelling and thickening in the mucosa due to hyperemia and inflammatory edema. The feces are fluid instead of solid in the distal part of the intestines and the mesenteric lymph nodes are swollen and red.

Treatment is attempted but, since sometimes it is delayed until the causative factors have initiated severe injury, little can be done except to administer the so-called intestinal astringents and to employ symptomatic treatment. Those animals that survive these enteric disturbances remain unthrifty and stunted.

Salmonellosis

The numerous different etiologic factors that have been reported by various investigators to be responsible for outbreaks of infectious types of swine enteritis or dysentery probably account for much of the difficulty and confusion of veterinary practitioners when attempts are made to diagnose and treat these variant forms of infection in swine. Biester, *et al.*,[1] described an infectious enteritis induced experimentally in more than 100 head of healthy swine by the feeding of *Salmonella suipestifer* organisms isolated from field cases. Although other microorganisms were shown to be associated, the authors considered *Sal. suipestifer* to be the primary etiologic agent since they were successful in reisolation of the organism and, by feeding the bacteria to other healthy pigs, reproduced the disease in practically 100% of the experimental cases. Autopsies performed on the fatal cases showed acute progressive inflammatory lesions with necrosis and other retrograde processes such as the formation of croupous or diphtheritic membranes in the stomach and small intestines.

Necrotic Enteritis

Kinsley[2] reported that in 50 outbreaks of infectious necrotic enteritis in pigs he was successful in isolating *Sal. suipestifer* from 40 of the animals. He believed that this organism is the primary cause of acute and chronic infectious necrotic enteritis. This author expressed the idea that other predisposing influences such as improper feed, unsanitary surroundings, and undue exposure may lower the resistance of swine and no doubt increase the susceptibility of the animal to infectious enteritis. He concluded, however, that it may occur regardless of the physical condition or environment of the swine. He did not consider age or breed to be important factors since swine of all breeds are susceptible to the infection and since the disease may occur in recently farrowed pigs or in mature animals.

Infectious Enteritis

Infectious enteritis is a term used by Kernkamp[3] to describe a serious inflammatory disease of the bowel. According to this investigator, the infection is characterized by the formation of diphtheritic and necrotic exudates that cover a greater or lesser portion of the mucosa in the cecum and colon, and the appearance of diarrhea usually of a "pea soup" or watery nature admixed with flakes or shreds of fibrinous or necrotic tissue. Considerable blood may be evacuated in some cases. As a rule this disease is most likely to occur in pigs between the ages of 2½ to five months. Bacteria of the genus Salmonella apparently are the etiologic agents.

Swine Dysentery

Swine dysentery is defined by Doyle[4] as a widely distributed infectious disease affecting swine of all ages but more destructive usually in the young and caused by some factor or factors present in the cecum, colon, or bowel discharge of infected animals. Doyle has succeeded in reproducing swine dysentery experimentally by feeding these visceral organs to healthy pigs. The common clinical symptoms and postmortem findings of this disease have been described by him.

The most conspicuous clinical sign is the profuse diarrhea, which in the beginning may not be diagnostic of swine dysentery. However, as the disease progresses, blood and shreds of mucus will be seen in the stools. This presence of blood and mucus is considered to be an important aid in diagnosis. In the later stages, fecal discharge may have a rice-water consistency because of exudate and desquamated epithelium. Although the animal will continue to eat and drink, it becomes dehydrated rapidly and loses weight. There is some evidence of generalized weakness but the affected pig may remain bright and not be depressed. Elevation of the body temperature is not a constant symptom. The postmortem findings show the typical lesions of swine dysentery occurring in the large intestines. Gastritis is observed but gross lesions in the small intestine rarely are seen. The pathologic changes in the mucosa of the cecum and colon will vary depending upon the severity and the stage of the disease. There will be a graduated range from marked congestion and reddening of the mucosa in the early stage of inflammation to diphtheritic exudation and tissue necrosis in the late stage. A line of demarcation is seen between normal and pathologic tissue at the ileocecal valve.

Doyle[5] reported isolating a Vibrio organism from the colon mucosa of hogs infected with swine dysentery. He found in these experimental studies that, when healthy pigs were fed cultures of the Vibrio, they usually developed a diarrhea. The diarrheal condition lasted from three to five days. Although it resembled that which is seen in cases of swine dysentery following the feeding of colons from animals dying of the disease, it was not as severe nor did it contain as much blood and mucus.

Swine dysentery, as it is seen in herds in Australia, has been described by Gorrie[6]. The clinical signs of the disease as reported by him are essentially the same as those seen in this country. He believes that the greatest difficulty encountered by practitioners is in diagnosing the disease correctly and in determining whether one is dealing with so-called necrotic enteritis, swine dysentery, or a dual infection. He believes that this difficulty will remain until the etiology of one or both of the infections has been established clearly.

History of Local Outbreak

In December 1951, there developed on a farm in our territory a serious outbreak of an acute, infectious hemorrhagic enteritis in a herd of 1,400 swine. This enteric disease caused death to 250 animals, ranging in age from suckling pigs to brood sows, before it was brought successfully under control. It has not as yet been established definitely how the etiologic agent in this outbreak first entered the premises. The owner has operated this garbage feeding operation for 30 years in the same location and, although he has suffered annual losses from the noninfectious enteritis mentioned earlier in this article, this was his first experience with contagious hemorrhagic enteritis and dysentery.

This is another of the numerous incidences that have occurred when the efforts of the veterinarian to control a contagious disease in livestock are hampered by poor sanitation, overcrowding, and improper nutrition. The swine on these premises are confined from the time of birth until they are ready for shipment to market in pens built of wood. Outdoor runs for the animals are not available. The floors are cleaned daily and covered sparingly with wood shavings or sawdust. From years of continued use, the flooring in the pens has become greatly worn as evidenced by cracked, warped boards. Since the owner made no attempt to separate the infected from the noninfected animals, the unsanitary conditions of

the pens may account for the flare-up of the infection about every ten to 14 days. The ation of street garbage is collected daily in the morning and fed in the afternoon. All the pigs are vaccinated against hog cholera with virus and serum when they are about seven weeks of age.

Clinical signs of the disease, such as fever (105-107 F.), shivering, stiff gait with an arched back, weakness, prostration, and dehydration, were observed. Onset of the infection was rapid. At first, the intestinal disturbance was manifested by a profuse yellow diarrhea, but as the infection progressed, the stools evacuated contained considerable amounts of blood and mucus. Mortality rate in the infected animals was extremely high.

It was found that unless the hog raiser kept a close check on the infected animals some of them succumbed to the disease before symptoms were noted. As a rule, however, if the infection was not checked, death occurred in about five days after the first appearance of the yellow diarrhea or in about two days after the first showing of blood and mucus.

Postmortem examinations conducted on most of the animals indicated a uniform reddening, or hyperemia, of the intestinal mucous membrane. This was more severe than in acute catarrhal infections. The mucosa of the colon and cecum revealed evidence of a diphtheritic inflammation and multiple hemorrhages. Occasionally there could be seen also the escape of extravasated fluid into the lumen of the large intestine. Scraping off the superficial layer of debris disclosed necrotic ulcerated areas in the mucosa.

Treatment

Graham, *et al.*,[7] reported sulfathalidine®[1] to have, ". . . merit in the treatment and control of swine enteritis when pneumonia is not a complication." They stated that of 707 pigs affected with enteritis 628, or 88.8%, recovered satisfactorily, in contrast to 79, or 11.2%, of the pigs that died or remained in an unthrifty condition.

The use of sulfathalidine for the prevention, treatment, or control of enteritis in garbage-fed pigs has been discussed by Edmonds[8]. The results obtained in one clinical study of 465 garbage-fed swine showed a 95% recovery as opposed to 80 to 85% mortality in the untreated controls. He found the drug to be an economic agent for the treatment of swine infections. Small amounts and few doses of the drug were necessary to overcome the infection. This author has published other reports[9,10] regarding the beneficial use of sulfathalidine therapy in the treatment of enteric infections in swine.

The use of organic arsenicals for the treatment of swine dysentery has been reported by Robinson[11]. He states: "It must be remembered that dysentery in the early stages may resemble salmonellosis or other types of scours, and if the arsenicals are used in these cases little or no response will be obtained and the disease will continue."

Boley and associates[12] have indicated that arsenic in the form of sodium arsanilate has value in the management of a natural outbreak of swine dysentery.

The different types of enteritis in swine as they are seen by the veterinary practitioner are difficult to diagnose accurately without the use of proper laboratory facilities. Because these laboratory facilities are not always readily accessible, and since any delay before instituting therapy may retard recovery, the veterinarian should select those preparations that have been found to be effective in the treatment of animal diseases without exhibiting undue toxicity when they are administered in therapeutic doses.

The results obtained by us in the use of low dosage aureomycin and naka-nic®[3] in this outbreak of hemorrhagic enteritis were not satisfactory, and since sulfathalidine is a safe, effective chemotherapeutic agent for the treatment of infected animals, it was decided that an experimental trial of a mixture of this sulfonamide with arsenic might prove effective.

The resulting preparation, thalivet,®[4] was dispensed in the drinking water, or as a drench to those animals not eating or drinking, at a dosage of one tablet for each 20 to 30 lb. of live weight. Usually treatment for one day produced excellent results in checking the diarrhea. Subsequent doses were reduced by 50% and administered as such for the next two or three days, in order to prevent recurrence of diarrhea.

Treatment with thalivet was used at different intervals for a period of about five weeks in the case of 300 affected pigs varying in weight from 10 to 15 lb. (suckling pigs) to 200 lb. The response was excellent except in

®[1]Sharp & Dohme, Philadelphia, Pa. Registered trademark for phthalylsulfathiazole.

®[3]Naka-nic is a preparation containing nicotinic acid, potassium chloride, sodium hydroxide, sodium thiosulfate, sodium bicarbonate, copper sulfate, phenolphthalein, sodium chloride, and aromatics, prepared by Pitman-Moore Company, Indianapolis, Ind.

®[4]Sharp & Dohme. Registered trademark for a tablet containing 2 gm. of phthalylsulfathiazole and 12 mg. of arsenic as sodium arsanilate.

about 1.5 to 2% of the animals, where the hemorrhagic enteritis was profuse and animals were dehydrated severely.

There were a few instances when a flare-up of the infection took place in ten to 14 days in those animals that suffered from the initial outbreak of the disease. This may indicate a possible reinfection in these pigs due to the poor sanitation, overcrowding, or the condition of the pens. A second course of treatment was equally as effective as was the initial therapy.

Summary

1. This article is a clinical report of a hemorrhagic enteritis outbreak and dysentery in one large swine herd.

2. Three hundred pigs in a herd of 1,400 animals were treated with thalivet. Of these, 290, or 96.6%, recovered as opposed to ten, or 3.4%, that died. Prior to treatment, 250 pigs in this herd succumbed to this enteric disease.

3. Thalivet, a combination of sulfathalidine and sodium arsanilate, is a safe, effective, and convenient chemotherapeutic agent for the control, prevention, and treatment of certain enteric diseases in swine.

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Infection Atrophic Rhinitis

(Continued from page 97)

pathiae (ATCC 10735) cells washed from the blood agar slant that had been incubated at 37 C. for 48 hours. The suspension of growth from one slant was stored for 18 days in the freezer similar to the 12 nasal turbinate suspensions and then was inoculated intramuscularly into two pigeons to determine if the erysipelas organism would remain pathogenic for that time.

All the pigeons died within 96 hours, including the two inoculated with the stored suspension of *E. rhusiopathiae* cells. Samples of heart blood inoculated on blood agar, yielded characteristic colonies which on the Gram stain gave the appearance of *E. rhusiopathiae*. The pigeons, therefore, were susceptible to the erysipelas organism but not to the causative agent of infectious atrophic rhinitis.

This experiment involving four positive herds of swine indicated that the causative organism of swine erysipelas is not the cause of, nor does it act as a synergist in causing, infectious atrophic rhinitis. This does not preclude the possibility that the two diseases can occur in the same herd concurrently.

Pigeons are not acutely susceptible to the causative agent of infectious atrophic rhinitis according to this experiment, and on this basis are of no value as a means of diagnosis.

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Vesicular exanthema is reported to be more widespread in California than in any other area in the United States, yet no known attempt has been made thus far there to eradicate this disease. Considering activities in livestock disease control in other directions, reasons for prevalence of this disease of swine in California and failure to take drastic action are not apparent.

On The Blood Picture Of Sheep Exposed To The Medium Stomach Worms III. Second And Third Exposures†

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THE main objective of agriculture is production. The successful food-producing animal is one which arrives at market weight and returns a profit for the farmer. Present-day food-producing animals attain market weight largely in spite of, and not in the absence of, parasitic infections. Parasitic infection results after exposure of the host animal and it appears true that few of our domestic animals escape repeated exposures. By strict definition from a parasitological viewpoint, the relationship between the host and its parasites after exposure must result in injury to the host. From the standpoint of production, the relationship between the host and its parasites must result in failure to gain weight properly. Failure to gain weight properly, loss of weight, and even death of the host can occur after exposure, but are conditioned for practical purposes by the age, diet, and previous exposures of the host, and by the number and virulence of the parasites in the exposure. Numbers of adult worms present in a host animal, on the other hand, are not an exact measurement of host injury; in the case of many of the important worm parasites of food-producing animals, the adult worms can be considered merely the progenitors of a new generation.

Greatest host injury occurs in the interval after exposure and before the parasites reach their adult stage. Whether the injurious effect of parasitism in the host is derived in larger part from the activities of the parasites or from the activities of the host animal in combating the parasites is an open question. It remains true that the majority of such infections reach only temporary, subclinical levels and their effects in the host animal are difficult to measure.

In order to establish effects of subclinical parasitism in domestic animals on their rate of weight gain, it would be necessary to compare their weight gains with those of animals absolutely not exposed to parasitic infection. Present agricultural standards for growth of food-producing animals doubtless have been obtained entirely from parasitized animals. While clinical parasitism (from the standpoint of production, clinical parasitism results in persistent weight losses or deaths) can occur in any flock or herd, it is noteworthy that in some individuals in the group clinical parasitism is always accompanied by subclinical parasitism in other individuals in the same group. Presuming that individuals in a flock or herd have equal opportunity for exposure, then two kinds of animals are present, those which sustain clinical parasitism and those more numerous individuals which sustain only subclinical parasitism. The latter undoubtedly occurs when some individuals are exposed to fewer infective stages of parasites than are others, but it is interesting to speculate whether some individuals sustain subclinical parasitism because they achieve more immediate mutual adjustments with their parasites.

Present data present the pattern of host reaction obtained by studying the blood pictures of lambs which received their second and third single exposures to infective larvae of *Ostertagia circumcincta* and *O. trifurcata.* Infections were permitted to proceed without interruption by anthelmintic treatment. Materials and methods used in these studies have been presented previously[1,2]. Infections derived from the single exposures can be classified properly as subclinical.

Observational Data

A record of the total red cell count, color index, and mean cell volume for each lamb during its second and third infections is shown in figures 1, 2, and 3.

Second Exposures. Each of the three lambs discussed in this study received 6,400 larvae

†The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

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for a second exposure. Lamb 1, given 300 larvae in its first exposure, was 7½ months of age at second exposure. Lamb 2, given 6,400

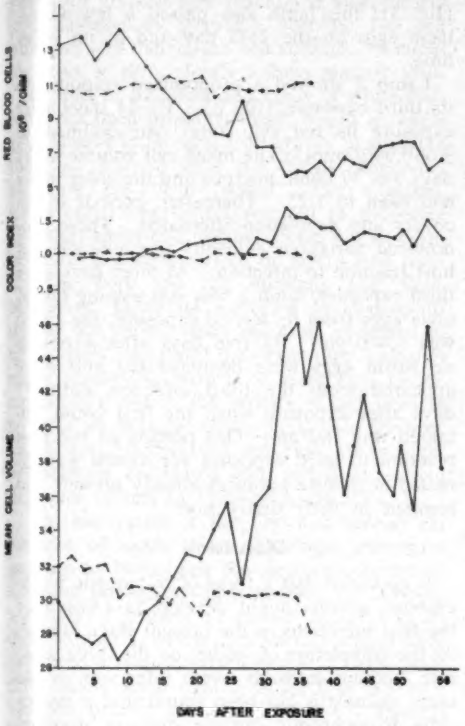

Fig. 1. Records of the red cell count, color index, and mean cell volume in cubic microns obtained at intervals indicated from lamb 1 following its second (————) and third (— — —) exposures.

larvae in its first exposure, was 4½ months of age at second exposure. Lamb 4, given 6,400 larvae in its first exposure, was seven months at second exposure. The interval between exposures for lambs 1, 2, and 4 was 200, 107, and 56 days, respectively.

The first response of lamb 1 to its second exposure probably can be considered a moderate hemoconcentration (fig. 1). Following a drop of the red cell count to 12,410,000 at five days after exposure, the count rose to 14,030,000 at nine days after exposure. The increase in red cell count was reflected by a decrease in the mean volume of red cells; the mean cell volume in cubic microns was 29.9 at zero days' exposure and 26.4 at nine days after exposure. Thereafter, lamb 1 progressed into a macrocytic, hyperchromic anemia. At 33 days after second exposure, lamb 1 had a red cell count of 5,590,000/cmm.; the mean volume of red cells had increased to 45 cubic microns (fig. 1). This form of anemia persisted for over 100 days after exposure and the red cell count at 122 days after exposure was only 10,340,000 with a mean cell volume of 33.3 cubic microns.

Ostertagia eggs were first passed by lamb 1 at 19 days after exposure and the count obtained was 80/gm. feces. The highest count obtained, 26,720/gm., occurred at 35 days after exposure; this infection, as judged by egg counts, persisted through 97 days after exposure, when the egg count obtained was 3,360/gm. In this exposure, first appearance of worm eggs did not coincide with the animal's recovery from its infection.

A hemoconcentration did not occur in lamb 2 following its second exposure. Its count declined from 13,682,500 red cells/cmm. at zero days' exposure to a low of 11,120,000 at nine days after exposure. These reduced counts gradually returned to higher levels, reaching a count of 13,180,000 at 55 days after exposure (fig. 2). Reductions in red cell counts were accompanied by increases in the mean volume of the red cells, although a marked hyperchromia did not occur (fig. 2).

At the time of its second exposure, lamb 2 was still passing small numbers of eggs from its first exposure. These counts persisted for 17 days after exposure, so that the original egg count in lamb 2 from its first exposure persisted for a total of 105 days from first appearance of the eggs. Egg production from the second exposure was first evident at 27 days after exposure. This count was highest at 55 days after second exposure when it was 1,840 eggs/gm. The highest egg count obtained in lamb 2 after first exposure to 6,400 larvae was 56,080/gm. at 46 days after exposure.

A hemoconcentration did occur in lamb 4 following its second exposure; hemoconcentration did not occur in this animal following its first exposure[1]. After second exposure, this lamb's total red cell count increased from 10,335,000/cmm. at zero days' exposure to 11,910,000/cmm. at three days after exposure. Thereafter, the count gradually declined to a low of 9,480,000 at 17 days after exposure. This lowest red cell count was accompanied by the highest mean cell volume of 36.4 cubic microns and a color index of 1.14 (fig. 3).

Following its first exposure, lamb 4 had egg counts beginning 24 days later and which reached a high of 10,160/gm. at 49 days after exposure. Lamb 4 received its second exposure 56 days after the first exposure; the original egg count gradually declined and was

no longer evident 40 days after second exposure, but no egg production with its source in the second exposure was recognized. These egg records are in contrast to those of lambs 1 and 2, each of which developed distinct infections following second exposure.

Third Exposures. The interval between second and third exposures of lambs 1, 2, and 4 was 129, 56, and 129 days, respectively. Lamb 1 was 11½ months of age at third exposure; lamb 2 was 6½ months, and lamb 4 was 11½ months. Each animal received 500,000 larvae although the records obtained from lambs 1 and 4 indicate that their exposure probably did not consist of many larvae in an optimum

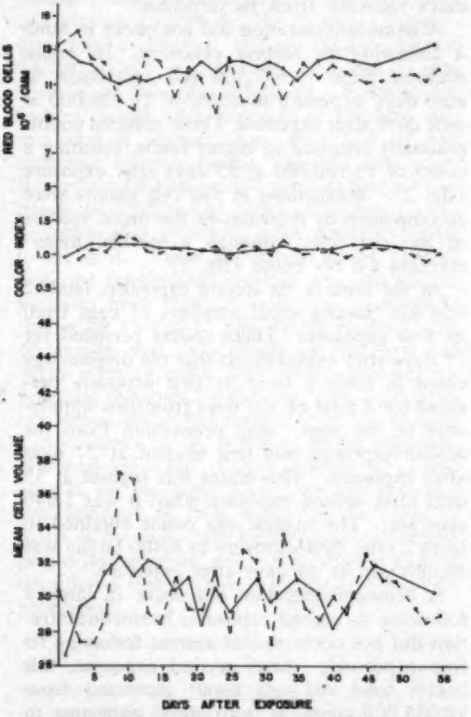

Fig. 2. Records of the red cell count, color index, and mean cell volume in cubic microns obtained at intervals indicated from lamb 2 following its second (————) and third (— — —) exposures.

infective state. Records obtained after third exposures are shown in figures 1, 2, and 3.

The blood picture of lamb 1 following third exposure (fig. 1) showed only small daily variation perhaps characteristic of all animals. No anemia nor tendency toward anemia developed. No Ostertagia eggs were passed by the animal in the period of observation shown in figure 1, or later, with the exception that flotation disclosed a few eggs on the 25th day. No definite trends were apparent in the blood picture of lamb 4 following its third exposure (fig. 3); this lamb also passed a few Ostertagia eggs on the 25th day and at no other time.

Lamb 2 showed a pronounced response to its third exposure (fig. 2). By 11 days after exposure its red cell count had declined to 9,680,000/cmm. The mean cell volume at 11 days was 37 cubic microns and the color index had risen to 1.25. Thereafter, periods of recovery and depression alternated. These pronounced variations evidently are indicative of host reaction to infection. At three days after third exposure, lamb 2 was still passing Ostertagia eggs from its second exposure; the count was 1,440/gm. By five days after exposure no worm eggs were demonstrated and none appeared from the third infection until 47 days after exposure when the first count obtained was 160/gm. One portion of the host reaction to third exposure apparently was directed at mature parasites already present and resulted in their destruction.

Discussion

It appeared that a form of microcytic hypochromic anemia might develop as a result of the first infections in the present three lambs'. At the completion of studies on the three separate medium stomach worm infections in the same animals it has been found that a microcytic hypochromic anemia did not develop. The anemia characteristic of the time interval when the experimental lambs were actively resisting infection, that is, in the interval after exposure and before sexual maturity of the parasites, and in each instance when anemia developed, was macrocytic and hyperchromic.

In presenting records obtained from the three infections, text figures are based on three variants shown by red cells in anemias, namely, number, size, and color. Percentages of packed cell volumes, and amounts of hemoglobin in gm./100 ml. are regarded at this laboratory to be largely reflections of absolute red cell numbers; graphs of such data parallel graphs of red cell numbers very closely. Amounts of hemoglobin present in a cell are expressed by the graph of the color index from which can be derived normochromic, hyper- or hypochromic values. Size of the red cells probably can be expressed most graphically by plotting mean cell volumes in cubic microns. In our experience, shape of the red cells is not easily graphed but generally is reflected by size of the cells, at least in these experiments. This is

to say, that anisocytosis is characteristic of these experimental infections, as are also poikilocytosis and polychromatophilia, but the period of greatest host reaction is most clearly demonstrated by graphing absolute red cell numbers and their mean cell volumes. Reticulocytosis, in turn, closely follows macrocytosis.

Graphs of numbers and kinds of white cells have not been presented here; trends in white cells appear to be most trustworthy in studying the time interval after the "crisis" following exposure has been passed[8]. For example, while certain exposures resulted in moderate anemias, white cell numbers were not as comprehensible during periods of severe host reaction as were red cell numbers and sizes. Moreover, moderate increases in eosinophils during the period when the hosts appeared to be actively resisting the immature parasites never resulted in records of more than 15.5% eosinophils, which the writers would hesitate to term an outright eosinophilia. In passing, Larsh and Nichols did not find an outright eosinophilia associated with initial or second exposure of rats to *Trichinella spiralis*[8].

The end result of the first and second exposures of lamb 2 to Ostertagia infections appears to have been the development of an acquired immunity which enabled the lamb to withstand a number of larvae, 500,000 in its third exposure, which undoubtedly would have produced a fatal infection earlier. Three hundred larvae given lamb 1 in its first exposure did not protect the same lamb 6½ months later from 6,400 larvae. Lamb 1 may have developed a low-grade immunity which deteriorated in the 200-day interval between the two exposures. Lamb 4 was not seriously affected by 6,400 larvae in its second exposure which it received only 56 days after first exposure to 6,400 larvae. In any event, and while the test parasites had their development restricted, recognition of an acquired immunity based on numbers of parasites developing from test exposures is not satisfactory from the standpoint of production. Weight gains were retarded following each exposure of the lambs, except in lambs 1 and 4 following third exposure. The three lambs were weighed at each instance shown in figures 1, 2, and 3, when blood samples were drawn. An immunity against subclinical parasitism theoretically should prevent retardation of weight gains.

The response of lamb 2 to its third exposure (fig. 2) and which can be considered a parasitological immune response, is a fair demonstration of the effort required to overcome a parasitic infection. In the first five days following third exposure the animal wiped out a previous infection which was resulting in an egg production of 1,440/gm. The animal greatly reduced numbers of worms maturing from its third exposure so that the highest egg production resulting from 500,000 larvae, 240/gm., occurred at 50 days after exposure. The maturity of worms from third exposure was delayed. In contrast, 6,400 larvae in the

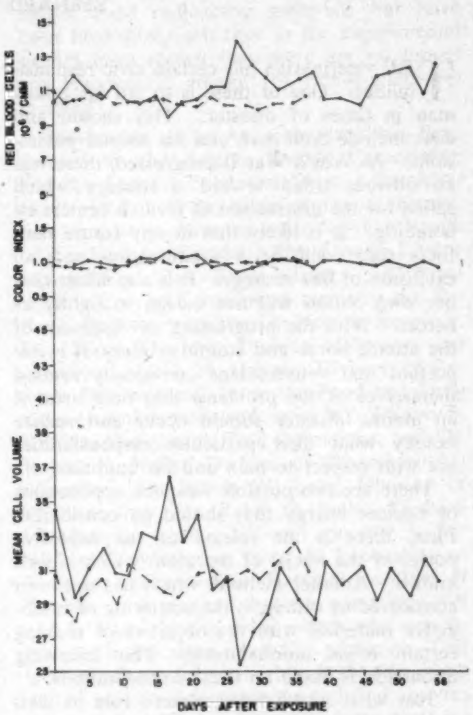

Fig. 3. Records of the red cell count, color index, and mean cell volume in cubic microns obtained at intervals indicated from lamb 4 following its second (.————.) and third (.— — —.) exposures.

lamb's first exposure resulted in a high egg production of 56,080/gm. at 46 days but eggs were first passed at 19 days when the count was 520/gm. The animal's first response, hemoconcentration, occurred immediately after exposure. Hemoconcentration in the first few days after exposure was characteristic of each lamb when the exposures produced noticeable and pronounced effects upon the hosts. Lamb 2 gave a response to its third exposure, even though it had acquired an immunity, which was very similar to its response following first exposure[1]. Evident changes in the condition

(Continued on page 110)

Civil Defense Problems Confronting The Veterinarian In An Atomic Age†

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THE veterinarian has certain civic responsibilities. One of these is to aid his fellow man in times of disaster. This should and does include both man and his animal possessions. As World War II progressed, there was an obvious trend toward a strategy which called for the destruction of civilian centers by bombing. It is likely that in any future conflicts there will be a continuation and an extension of this strategy. It is also likely that our own nation will not escape so lightly as before. With the progressing development of the atomic bomb and atomic artillery, it is important that veterinarians continually remind themselves of the problems that may arise if an atomic disaster should occur and realize exactly what their particular responsibilities are with respect to man and his animals.

There are two possible weapons applications of nuclear energy that should be considered. First, there is the release of the explosive power of the nuclei of the atom which is well known. Another method, which has not been considered so widely, is the scattering of radioactive materials with the objective of making certain areas uninhabitable. The following discussion is based on these considerations.

Just what is the veterinarian's role in civil defense planning? It does seem reasonable to suppose that no great effort will be made by an enemy to expend atomic weapons upon the animal population. If by chance animals are destroyed, this is an unexpected dividend for the enemy. But the prime targets will be highly industrialized areas and residential districts, where animal populations are not dense. It is likely that stockyards and slaughtering facilities might be located within these industrial targets and thus be destroyed because of their proximity. The complete loss of animals within the stockyards would not be so great a disaster to our economy as the loss of the slaughter house, where facilities must be replaced.

It might prove difficult to try to save pet animals in time of disaster. But it probably will be important to reduce the number of stray cats and dogs. This will lessen the likelihood of an outbreak of rabies which might become a serious problem. There are some things that the operators of small animal clinics can do to aid in a disaster situation. In many of our cities, the veterinary clinics are located about the periphery where the least devastation would be expected, and thus they might serve as dressing stations or even temporary outpatient clinics, manned of course by medical colleagues. Since all of these veterinary hospitals are well supplied with sterile dressings, surgical equipment, and other medical supplies, they could serve in this capacity. The veterinarian, because of his training, could contribute his service.

Disaster Teams

Bombed cities will probably call upon neighboring communities for aid in health problems. Incident to advanced planning for such assistance it would seem logical to form disaster teams whose roster would include physicians, nurses, physicists, sanitary engineers, and veterinarians. The veterinarian's knowledge of sanitation and preventive medicine would alone make him a valuable member of such a group. Veterinarians will also be able to contribute to problems of food inspection including those where radioactivity contamination might be involved.

Farm animals, as mentioned before, are an unlikely target for weapons of the type under discussion. This is a fortunate circumstance. It means that our nation's reservoir of food animals will probably be disturbed but slightly. Should there be a rain or fall-out of radioactive materials, such as did occur in the first test of the atomic bomb, there might be some animals affected. After watching such animals for nearly seven years it can be said that no one would have been harmed had they eaten the meat derived from them at any time during those years. If these fission products fall on

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the grass or soil there is the possibility that animals will consume some radioactive materials. However, intestinal absorption is so slight that negligible quantities of potentially dangerous radioactive materials will be taken up by grazing animals.

Dangers of Peace Time Use of Nuclear Energy

A question that is frequently asked concerns the peace time uses of nuclear energy. It is conceivable that industrial or other uses might lead to a moderate spread of radioactive particles in nearby pastures or waterways. Unlike the atomic blast, this could continue over a long period and it may be that there will be a hazardous build-up of radioactivity. However, the Atomic Energy Commission has been able so far to control conditions for the use of radioisotopes so that there has not been any such spread of dangerous materials. There is no good reason to expect a change in the future.

Meat Inspection

From the standpoint of the veterinary food inspector there are two instances in which professional services will be needed. The first instance is in case animals consume radioactive forage. Because of the hazard of eating meat derived from carcasses of these the following procedure is suggested: Animals should be monitored out in pens; if there is any activity they should be discarded or washed down thoroughly. Then they may be checked with a survey meter after being dressed out.

There is a second circumstance, which as yet has received little attention. What should be done with food animals that have been exposed to whole-body irradiation and are presented for slaughter? In order to salvage as much food as possible, a policy will be needed for the guidance of veterinary food inspectors. There are numerous questions that will need to be answered. What shall be done with those that have been exposed to external irradiation at low levels so there is no sickness caused or anticipated? What will be done with those that have been exposed to whole body irradiation where there has been some irradiation sickness produced but animals have recovered and there are no observable symptoms or biochemical changes? What will be done with animals which have been exposed to whole body irradiation and which have become noticeably sick but have been held until such time as they are apparently completely recovered? What will be done with animals that have been exposed to external irradiation in such amounts that some of them will probably die within 30 days, but as yet there are still no symptoms of the injury present? What will be done with animals which have been given short lived radioactive materials and have been held for a sufficient number of half-lives so that there can not be any significant amount of radioactivity left in the body? What will be done with animals which have been given longer lived radioactive materials but have been held until such time as the experimental studies have shown that there are no longer any measurable amount of radioactivity remaining?

Fortunately an *ad hoc* committee has been formed by the Atomic Energy Commission and the Federal Food and Drug Administration to study such problems of mutual interest. The temporary chairman is Dr. S. Allan Lough of the Isotopes Division, The Atomic Energy Commission, Oak Ridge, Tenn. Additional Atomic Energy Commission members are Dr. S. G. English, from the Division of Research, Dr. Charles Dunham, Division of Biology and Medicine, Mr. J. H. Hayner, Division of Reactor Development. From the Food and Drug Administration were appointed Mr. Winton B. Rankin, Division of Field Operations, and Dr. Robert D. Heller, Division of Pharmaceutical Chemistry, Dr. Edwin W. Laug, Division of Pharmacology, Dr. Ralph G. Smith, Division of Medicine. An additional member is Dr. William G. Workman, from the Laboratory of Biologics Control of the National Institutes of Health. It is planned that this committee will call in from time to time, others who are interested in the same or similar problems. This is a major step forward. No doubt this group will be able to seek questions and find answers that will be of help to the veterinary food inspector in the event he is confronted with these problems.

So far the discussion has been concerned with generalities. It is therefore important that there be some speculation in the realm of the type of specific problems or situations a veterinarian might need to be prepared to handle. Much of what will follow will be the purest of speculation, built upon information derived from various official publications. In an effort to make this information more lucid, it has been consolidated into tables for comparison. These tables have classified the types of detonations into high air blast, the low air blast and the underwater and underground blast. These are the most logical types to study because they have different effects upon personnel and animals.

Blast Effects

High Air. First let us consider the blast effects of the high air atomic bomb explosion. Japanese medical observers could find no evidence of direct damage to internal organs of man caused by the blast. Autopsy material bore this out. The blast syndrome under these circumstances then should not be considered of great importance to living animals. Indirect injuries such as fractures or contusions due to flying debris, might occur up to four miles from the epicenter. Animals so injured, in many cases, must be humanely destroyed. As for foodstuffs, much would depend upon the types of packages and the contained food products, but in general there would be considerable breakage and destruction of packages which would also be contaminated by the debris.

In so far as food and containers are concerned, it would seem that there would be little direct destruction due to the bomb flash. The temperature while high, is of short duration and does not penetrate deeply. Fires started by the exploding bomb probably would be extinguished by the blasts of wind that follow if the distance is not too great from the epicenter. Thin paper and rotted wood caught fire from thermal radiation up to 3,500 feet from the ground zero in one of the Japanese blasts. It might be expected then that the effects from thermal radiation would in some favorable circumstances start fires and expose wooden and paper packages of food, but that certainly need to be made as to what animals could be salvaged. This points out the need for guidance from the *ad hoc* committee mentioned above.

TABLE 1. Effect of High Air (20 KT*) Blast Upon Food Animals and Packaged Foods

	Food Animals	Packaged Foods
Blast effect	1. Blast syndrome (minimal)	1. Contamination from debris
	2. Fracture, contusion, lacerations, up to 4 miles gradually reduced from 0 to point	2. Breaking and distortion and destruction of packages
Heat effect	1. Within 3,000 meters of epicenter, probably need treatment	1. Little effect upon food from flash; flame burn might be destructive in extreme
	2. Probably selectively burned depending upon color of animal	
Radiation effect	1. Within ½ mile, death soon	1. Contamination from fission products negligible
	2. Within 1½ mile, injury variable up to and including death	2. Neutron flux of no consequence
	3. After effects-pneumonia, T.B., septicemia, genetic(?), heredity(?)	3. Gamma and *x*-radiation no problem

*Equal 20 kilo tons of TNT

Up to 3,000 meters (approximately 10,000 ft.) from point zero, the heat from a high air blast might cause injuries to animals requiring treatment, if available. Those near the center would undoubtedly be the most severely harmed from flash burns. Flame burns would depend upon the distribution and nature of the burning debris. It is conceivable that in a crowded stockyard large numbers of animals might be exposed. It is quite likely that the animals would be sacrificed in the face of an atomic disaster because there would undoubtedly be a critical shortage of time, personnel and medical supplies for the care of people in the area and none available for animals. If this were not the case, then a selection would the greatest damage would come from the flames that grew from the original fires. This could be extensive.

If it is assumed the high explosion was from an atomic weapon such as was detonated over Japan, certain assumptions can be made regarding irradiation hazard to exposed animals. There can be various degrees of these effects depending upon many factors such as terrain, meteorological conditions, height of detonation and distance from the exploding bomb. Within half-mile of point zero, animals would be exposed to a severe dose of irradiation, enough to cause death within a few hours. From one-half to one mile only a few deaths from radiation would occur. For one mile upward the

severity of the radiation exposure would be greatly lessened. It must be assumed that all food within such an area is contaminated. It is likely that contamination by fission products and induced radioactivity due to the neutron flux would be negligible but all food should be examined for radioactivity. Actually, except for canned food, decontamination would probably be impractical.

Low Air. Discussion of the effects of the low air detonation of an atomic bomb overlaps to a considerable degree that of the high air blasts. The blast near the explosion will likely be extremely vigorous. It might mean complete destruction to animals nearby. Fortunately, the extreme effects fall off much more rapidly than those of the high air blast. It is a speculative but a reasonable assumption, that there would be severe destruction near a target and probably only at the periphery of the affected area could anything be salvaged.

At the site of the explosion there would be, for several hours, an untenable zone for animals. Any found there would suffer variously from an acute radiation syndrome, depending upon the length of exposure. By six hours, animals could walk safely across the area. Radioactive dust might constitute a hazard; at Alamogordo it was some time before it all settled. Another hazard would be from a fall out of radioactive bomb by-products and dust drawn up into the air by the rapidly rising hot air mass. In practice, this probably would be of minor importance because of its spotty nature and extreme dilution of radioactivity.

Packaged foods will not be bothered by gamma or *x*-rays. It has been suggested that the neutron flux might add a hazard by inducing radioactivity in the food and its containers. The extent of such activation would depend upon the chemical composition of the food and its container and particularly the neutron flux. Rough calculations lead one to believe that no great problem exists in this respect.

Underground Blast. So far as the underground or underwater detonation is concerned, much depends on the depth of the explosion and the amount and kind of materials suspended within the water or earth. Packaged foods unless very close would not be disturbed by the blast. This is true due to the fact that the water or earth smothers much of the explosive effects of detonation. Heat effects upon animals or food would not be expected for similar reasons.

TABLE 2. Effect of a Low Air (20 KT) Blast Upon Food Animals and Packaged Foods

	Food Animals	Packaged Foods
Blast effect	1. Blast syndrome maximal near target, possible complete destruction	1. Severe destruction near target
	2. Traumatic effects not felt so far away as high air blast	2. Salvage only at periphery of blast area
Heat effect	1. Near blast center, rapid lethal response (difficult to separate from blast effect)	1. Severe destruction near target 2. Salvage only at periphery of blast area
Radiation effect	1. Severe acute radiation problem for a few hours about site	1. Gamma rays—no problem
	2. Animals walk across blast area after 6 hours	2. Neutrons—little problem, depending upon container
	3. Fall-out of radioactive debris and dust—minor problems	3. Fall-out—problem of decontamination depending upon type of package or container

The most serious problem will no doubt be the spread of radioactive material on animals or stored food by the fall-out, which may be severe. Possibly there would be the same type of contamination through the base surge in the case of water. It is most probable decontamination procedures would be a useless and dangerous effort for many hours if the food product or animals were reasonably close to the fall-out. An additional factor with reference to the water blast that should be given attention is the possibility of biological cycling and concentration in marine life. No accurate estimate has been given for the extent of such a phenomenon. If it proves later to be a problem for food inspectors, it may become necessary to check fish caught in the general area of previous underwater atomic bomb detona-

tion. At the present time, it is not believed to be of great importance.

Summary

This then is a summary of what the veterinarian may expect to encounter in the event of an atomic disaster and some of the steps that are being taken to determine his role. Whatever it may be, it is a foregone conclusion that the veterinarian will fulfill his job with the intelligence and vigor for which he is so widely known.

TABLE 3. Effect of Underwater and Underground (20 KT) Blast Upon Food Animals and Packaged Foods

	Food Animals	Packaged Foods
Blast effect	None upon livestock—kills fish in vicinity	Probably none
Heat effect	None	Probably none
Radiation effect	1. Contamination by fall-out over a few thousand yards—severe 2. Contamination by base surge (?) 3. Biologic cycles started by simple animals and plants	1. Contamination by fall-out 2. Contamination by base surge

Blood Picture of Sheep

(Continued from page 105)

of the digestive tract, or host response directed against parasites with which it had previously reached an adjustment, occurred following the third exposure. These events following third exposure are reflected by the pronounced variations in red cell numbers and mean cell volume of lamb 2 shown in figure 2.

Summary

The blood pictures of lambs given second and third exposures to the two medium stomach worms, *Ostertagia circumcincta* and *O. trifurcata*, have been studied. Following exposures which affected the lambs, and in the interval before maturity of the parasites, macrocytic, hyperchromic anemias developed. Microcytic, hypochromic anemias did not occur. Maturity of the infections was delayed in lambs which had sustained previous exposures, but in general, host recovery from infection was associated with the beginning of egg production by the parasites. None of the infections produced were considered more than subclinical in nature. The relation of subclinical infection to weight gains of the host was discussed.

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Dr. T. A. Sigler, practitioner at Greencastle, Ind., recalls that the technic for vaccination of calves against blackleg has progressed through a number of stages. Initial technic was to suture a length of string carrying killed organisms, through the skin. Injecting dry pellets of killed organisms under the skin with an ingenious trigger syringe was substituted for the earliest technic. Later, aggressins replaced pellets, replaced in turn by filtrates, then bacterins, and finally combination bacterins having high efficacy.

▼ ▼ ▼

Mrs. C. M. Rodgers, Blandinsville, Ill., secretary of the A.V.M.A. Women's Auxiliary, reported at the Tri-State Veterinary Medical Association meeting in Memphis last month that they had provided eight loans of $400. each for senior veterinary students in 1952. These loans are paid on a schedule of $200. at the end of the second and third years following graduation.

The Auxiliary also awarded 17 prizes of $25. each in 1952 to students of various colleges who were selected as having made the greatest contributions to the advancement of the veterinary school on the university or college campus.

Energy Requirements Of Dogs*

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ONE of the problems often confronting the veterinarian is that of estimating the caloric requirements of dogs. While the problem in the hospital is one of meeting the nutritional requirements, the problem in the home is frequently one of restricting the animal to its needs. In either case, an easy and accurate procedure for the estimation of caloric needs would be helpful to the veterinarian. This paper reports some of the factors to be considered and suggests a rapid method of calculation based on studies of the metabolic rates of dogs under kennel conditions.

In a discussion of the caloric requirements of an animal species, it is well to start with a definition of "caloric requirement." It has been defined by Keyes[1] as the energy intake that will just balance the current energy expenditure. Metabolic energy is commonly expressed in terms of the large calorie or the amount of heat required to raise one liter of water one degree centigrade. Thus the requirement is a measure of the balance between input of energy in the form of food and the expenditure of energy in the form of work, heat, and waste product formation resulting from activity and metabolism. Keyes[1] distinguishes three requirements: (a) the current balance requirements of the animal in its present state; (b) the theoretical requirement of the animal to maintain its ideal body size and activity; (c) the therapeutic or the requirement calculated to correct alterations in body size or to meet faults in metabolism arising from disease.

In providing for therapeutic nutrition, it is sometimes forgotten that the energy requirement is the first need that must be met. Energy is in the continual process of being used and lost by the body and if this loss is not met by energy, in the form of food, absorbed from the digestive tract or by parenteral feeding, it will be met by the utilization of the animal body tissue itself. This results in the use of body protein for energy at a time when the need for protein as its fundamental units, amino acids, is greater than normal for the maintenance of body tissues. Although fats and carbohydrates are stored in the body, the supply of carbohydrate is not adequate to supply energy needs for more than a few hours. Fat, for proper metabolism, requires the presence of intermediary products that are ordinarily formed from carbohydrates but which in their absence must come from protein. Thus even in a well-nourished animal a failure to supply energy from the digestive tract places a demand on body protein. In the diseased animal, which does not have a food intake sufficient to meet the caloric needs, this need for proteins places an additional strain on the body when it can least afford to meet it.

To meet these needs, it is desirable to calculate the energy requirements of an animal under any particular set of conditions so any caloric deficiencies can be determined and corrected. To assist in these calculations there are available tables of the caloric requirements

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for dogs of varying weights. One of these, by Arnold and Elvehjem,[2] was derived by feeding tests. Another commonly used method is to calculate the need on the basis that the fundamental requirements for dogs is 80 cal./kg. of body weight per day as suggested by Emerson[3]. Either of these methods is adequate when used under the proper conditions but they do not take into account the different activities of dogs, the different mature body sizes of dogs, nor is there any way of compensating for the additional requirements due to the change in body temperature during a fever. Another method is to start with measurements on the metabolic rate under standard conditions and add to these figures increments for activity, age, and fever. This is the method that was used to determine the procedures given in the appendix.

Measurements of Metabolic Rates

As a basis for this method, measurements were made on the metabolic rates of 160 dogs. It is not assumed that these are a measure of the basal metabolic rate, for they are known to be higher than the standards given by Brody[4] but rather they are figures for the metabolic rates of dogs in a postabsorptive state maintained in cages limiting the activity to that which would be found in the kennels and runs of a veterinary hospital. To obtain the postabsorptive state, the feed had been withdrawn from the dogs 24 hours before the test was made. The animals were anesthetized with sodium pentothal before the metabolic rate was determined, which eliminated any activity that would have interfered with this measurement. These measurements, made with an indirect calorimeter, are considered to be a good estimate of the metabolic rates of kennel maintained dogs and can be used as a starting point from which to calculate the energy requirements. Observations were also made on weight, pulse, temperature, respiration, temperament, and general body measurements.

The 160 dogs, mostly mongrels, used in these tests can be divided into the following age groups: adults, those about one year, those about six months, and those about three months of age. Within the range of weight encountered in these adult dogs, 5 lb. to 65 lb., a satisfactory linear relationship was found between the weight and the metabolic rate, and from this it is possible to set up a simple formula using the weight of the animal to calculate the caloric needs. The formula is given in the appendix. An allowance of 10% has been made for the specific dynamic action or heat increment of the feed. This figure is suggested by Keyes[1] for a mixed diet and is based on a number of reported studies of the specific dynamic action of food. (The specific dynamic action of food can best be described as the energy lost from feed due to the work involved in digesting the feed and making it available to the body systems.) Also in the appendix are percentage allowances for the younger age groups of dogs that should be added to the basic allowance. Included in the appendix is an example of the calculation using this formula for a 20 lb. dog of the various age groups.

Converting Caloric Requirements to Weight of Feed

For practical use the caloric requirement must be converted into terms of weight of feed to be given to the animal. If dry dog feed is to be used the amount of fat in the feed must be taken into account. Until recently most dry feeds contained only negligible amounts of fat, but the development of efficient compounds to prevent fat from becoming rancid has made it possible to include as much as 10% of this ingredient in dry dog feeds. A feed with 2-3% fat contains an estimated 1,400 calories per lb., 9% fat raises it to 1,500 calories per lb. These estimates are based on an allowance of 5% moisture and 75% utilization as suggested by James and McCay[5]. The usual canned dog feed contains about 70% moisture or about 30% dry matter and is estimated to contain about 420 calories per 1 lb. can. If the better class of canned prescription diets are used, a higher caloric content estimation per pound can is justified depending on the composition of the type used. It is customary in making these calculations to allow 4 cal./gm. of protein and carbohydrate or nitrogen-free extract and 9 cal./gm. of fat. With these figures it is possible to estimate the caloric values of the various feeds and apply the formula in the appendix to estimate the needs of the dogs which weigh up to 65 lb. With dogs of the large breeds weighing over 65 to 70 lb., it is better to multiply the weight in pounds by 18 to obtain the basic caloric need instead of using the formula.

All figures such as these are at best estimates and need to be used with some thought as to the particular dog for which they are calculated. A number of factors which are impossible to assess by methods readily available must be considered: the temperament of the dog, the activity, the age, and the general environment in which it is kept. A highly

nervous dog will require a greater calorie allowance than a quiet one, and likewise a young, active dog requires more than an old, phlegmatic one. If a dog is left outside most of the year, the changes in temperature must be taken into consideration. Attempts have been made to estimate the additional requirements imposed by the activity of the animal and Dechambre, as quoted by McCay,[8] estimates that for moderate work the feed needed is increased by 25% and for heavy work the need is increased by 60%. These again are estimates and must be tempered by consideration of the specific animal.

A considerable amount of study by DuBois[7] has been devoted to the problem of the additional energy requirements imposed on animals by fever. It has been shown that there is a moderate increase in the metabolic rate. The rise in temperature is due to changes in the heat regulatory center in the hypothalmus resulting in the establishment of a rate of heat loss which produces a higher body temperature. This rise in metabolic rate should be used in calculating the energy requirement of the febrile animal. For each degree Fahrenheit rise in temperature there is a rise of 7% in the metabolic rate. Thus for an animal with three degrees rise in temperature, the caloric requirement will have to be increased by 21%. This increase in the caloric intake will assist to combat the protein loss from the body but there is a good chance that even this much increase will not completely preserve the nitrogen balance and it may be desirable to increase the energy intake even further, if possible. Securing a sufficient intake of feed in the febrile animal is a problem and it is possible that more damage will be done by force-feeding the animal rather than waiting until it will consume the feed. This is a phase that needs further study and it is not within the scope of this paper to discuss the methods of force feeding animals.

Energy Requirements for Pregnant and Lacating Bitches

The pregnant and lactating bitch presents a special problem in the determination of the energy requirements. Up to the present, little study has been made on the additional energy allowances that must be made to the diet to maintain lactating females. Most females arrive at the end of pregnancy in good condition but lose weight during the succeeding six weeks of lactation. In a study on lactation using Boston Terriers, Daggs,[6] using diets containing liver, eggs, or round steak as sources of protein, found that the following increased allowances above maintenance level would produce positive nitrogen balances and maintain weight:

Ninth week of pregnancy allow	+20%
Parturition allow	+25%
Second week of lactation allow	+50%
Third week of lactation allow	+75%
Fourth week of lactation allow	+100%

The females in these studies were limited to nursing three pups and were allowed only one hour of exercise a day. The average daily gain for pups was 35 gm./day when the bitch was on the egg protein diet and 48 gm./day when the bitch was on the liver protein diet. Whether these allowances are adequate for a female with a litter of more than three pups is difficult to ascertain for the three may consume as much as six if given access to that much. However, a time factor is involved in the rate at which it is consumed and with six pups the rate of consumption may be high enough to result in a greater milk production. In dairy cattle, it is well known that while four milkings daily will increase the yield over two milkings, it nevertheless will not double the production. These allowances then serve as a basis upon which to feed the lactating bitch and somewhat greater allowances seem advisable with larger litters.

It may be difficult to get an animal to consume amounts of feed to meet the energy requirements of milk production, but no great harm will arise if part of the need is met by use of the body tissues. It is well, however, to make every effort to meet the energy requirements without the animal having to resort to using the body tissues.

Appendix

Formula for the calculation of energy requirements:

1. Formula for daily caloric needs of adult dogs of 5 to 65 lb.

Calories per day $= X(33\text{-}\frac{1}{4}X)$

X = weight of dog in pounds.

2. Formula for daily caloric needs of adult dogs over 65 lb.

Calories per day $= 18X$

3. Percentage increments to be added to the basic allowance for younger dogs.

Those about one year of age	—add 10%
Those about six months of age	—add 30%
Those about three months of age	—add 60%

4. Percentage increments to be added to the basic and age allowances for activity or work.

For moderate work—add 25%
For heavy work —add 60%

5. For febrile animals, add a 7% increment for each degree Fahrenheit above the normal body temperature.

Example
20 lb. dog.

1. If an adult X=20 lb.
   Calories per day=20(33-¼ x 20)
   =560 calories
2. If six months of age
   Calories per day=30% of 560
   (168) + 560
   =728 calories per day.
3. If the six-month-old dog has a fever of 3 F.
   Calories per day=728 + (3 x 7% of 728) or
   =728 + 153
   =881 calories

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Midwest Small Animal Association and Regional A.A.H.A. at Burlington, Iowa

A record crowd of 104 veterinarians registered for the joint meeting of the Midwest Small Animal Association and the regional A.A.H.A., November 12-13, 1952, at Hotel Burlington, Burlington, Iowa. The first afternoon and evening were devoted to the problems of hospital management. Panel discussions on these subjects were held. The meeting on Thursday was devoted to scientific papers, with Dr. Lloyd C. Moss, Department of Medicine, Colorado A. and M. College, Fort Collins, Colo., and Dr. George W. Mather, Department of Small Animal Medicine, School of Veterinary Medicine, St. Paul, Minn., participating.

The newly elected officers of the Midwest Small Animal Association for the year 1952-53 are as follows: Irvin P. Irwin, Iowa City, Iowa, president; Frank Booth, Elkhart, Ind., vice-president; J. Porter Coble, Springfield, Ill., secretary-treasurer; John N. McIlnay, Omaha, Neb. and Wayne H. Riser, Skokie, Ill., trustees.

The Midwest Small Animal Association at its business meeting voted to make a second donation of $150. to the research fund of the American Veterinary Medical Association. The Midwest Small Animal Association has the honor of having made the original donation to the A.V.M.A. in 1945 for research purposes. This second gift is indicative of the confidence this group of practitioners has in the benefits to be derived from organized veterinary research.

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Dr. Ethel McNeil Receives National Research Award

Dr. Ethel McNeil, staff member, College of Veterinary Medicine, University of Illinois, Urbana, received the National Turkey Federation's research award which was presented at the organization's annual meeting held at Dallas, Tex., January 8, 1953.

Doctor McNeil was presented with the award plaque and a check for $500. in recognition of her contribution to the turkey industry through her research on turkey diseases during the past 16 years. In addition to discovering the cause of hexamitiasis in turkeys, she also conducted important studies on paratyphoid infections, pullorum disease, fowl cholera, and protozoan diseases.

With Dr. W. R. Hinshaw, formerly of the University of California, Doctor McNeil discovered that many paratyphoid infections which are found in birds are also found in man and in other animals, including reptiles. They also developed a blood test for paratyphoid infections in turkeys.

Doctor McNeil was appointed to the staff of the University of Illinois in 1950. Since then she has divided her time between veterinary research in the agricultural experiment station and instruction in the College of Veterinary Medicine. She is associate editor of *Poultry Science*, as well as a member of numerous national scientific organizations.

EDITORIAL COMMENTS

Control Procedures of Vesicular Exanthema Ineffective

Vesicular exanthema has recurred in some of the same garbage feeding establishments where it occurred in late summer of 1952. Press releases from the USDA advise of re-establishment of quarantines in counties and other political subdivisions that were previously quarantined and released after infected and exposed hogs were slaughtered and processed (cooked) for food, and premises disinfected under supervision of state and federal officials.

First quarantines imposed because of outbreaks of this vesicular disease of swine were announced by the USDA July 29, 1952. Areas affected by restrictions have been changed from time to time as spots of infection broke out or were cleaned up. Some areas have been placed under quarantine at different times when infection appeared repeatedly, usually among swine fed raw garbage. The most recent release as of this date lists areas under quarantine that affect various counties and townships in 12 states, including all of California.

Opinion has been expressed by some livestock officials that control and eradication of vesicular exanthema in swine presents problems that are proving to be more difficult than any dealt with previously. The reasons for this are not clear. Authorities have expressed the firm conviction that vesicular exanthema is primarily a "garbage-fed-hog disease." Furthermore, that "the feeding of raw garbage is one of the most important factors in the spread of virus" and that "the cooking of garbage used as hog feed would be a most important step toward control and final elimination of the disease."

Considering characteristics of this disease and the history of its occurrence in California for 20 years and its spread over the United States in recent months, it can hardly be successfully denied that pork scraps in raw garbage are a principle source of infection. It is believed that there are quantities of infected raw pork in trade channels that may be the source of further outbreaks.

In consideration of these and other pertinent facts, why does the swine industry allow a small segment to jeopardize the whole? Is political intrigue a factor? Various estimates

Photo courtesy Drover's Telegram, Kansas City, Mo.

This is a picture of destruction - - - destruction of hogs infected or exposed to vesicular exanthema, in a garbage feeding lot in the Midwest. Animals were subsequently hauled to a rendering plant and converted into edible fat and fertilizer.

place the garbage-feeding portion of the entire swine industry at 0.5 to 1.5%. Application of regulations based on laws regarding dangerous foodstuffs, and prompt legislation requiring universal cooking of garbage prior to feeding swine are logical control steps. It could be expected to be more effective not only in the control of a disease that threatens extinction of swine culture, but of other serious diseases of swine, some communicable to man. Vesicular exanthema must be eradicated promptly. *Imminent danger lies in its continued existence.* Similarity of symptoms of this and foot-and-mouth disease has been pointed out repeatedly. There exists a threat to all livestock activities.

What has been accomplished in control? Have methods been effective? The answer is contained in news releases of repeated outbreaks in previously quarantined areas and infection in new areas. Archaic methods are being used that were employed years ago in the eradication of other livestock diseases. Of this there is accompanying photographic proof. The shots fired here are certain to resound against the backboard of public opinion that will serve to intensify the volume to a resounding demand to apply those measures that advanced veterinary medicine has indicated will serve best to control disease, be economically feasible, and relieve the threat of reduced supplies of safe meat with the least burden on the taxpayer. These "horse and buggy" methods are ineffectual in this enlightened time. No significant reduction of infection is accomplished by "execution" of infected herds if it is accepted that virus does exist in raw pork in trade channels.

Can the veterinary profession accept the tribute made to it in a recent statement that "We are alert" unless it recognizes the problem here and takes up arms to deal properly with it? The ugly heads of swine diseases, not the victims of them, should be the target.

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Dr. E. W. Rivers of Melrose, Mass., and Dr. H. F. McMurray of Nashua, N. H., served as official veterinarians at the New England Chinchilla Show held in Boston, Mass., on January 23-25, 1953. Both have interested themselves in the care and treatment of chinchillas and believe that the breeding of these fur-bearing animals will continue to expand rapidly, providing a rich new field to alert practitioners.

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Lentin (3.5 cc.) has proved helpful in treating bloat in cattle.—*Harry Johnson, D.V.M.*

Doctor Traum Named Chief Scientist for Plum Island Research Institute

Dr. Jacob Traum has been named a chief scientist for the Plum Island Animal Disease Research Institute.

Doctor Traum has been serving as professor of veterinary science at the University of California's School of Veterinary Medicine since 1914. In his new position, he will be responsible for virological and bacteriological studies at the institute.

Doctor Traum is a recognized authority in bacteriology and virology, and has made significant contributions in both fields. He was the first to discover the organism which causes brucellosis in swine, and the virus which causes vesicular exanthema. He has carried out research studies on foot-and-mouth disease in several European countries and in Mexico, and took an active part in the eradication campaigns during several outbreaks of the disease in the United States.

Doctor Traum received his degree of Doctor of Veterinary Medicine from the New York State Veterinary College at Cornell University in 1905 and a Master's Degree from the same university in 1923. He served with the Bureau of Animal Industry from 1905 to 1914, as a specialist in foot-and-mouth disease from April 25, 1925, to October 31, 1926, while on leave from the University of California, and as a consultant since September 17, 1947.

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James L. Fox, superintendent, Food and Drug Administration, Illinois Department of Agriculture, is urging that state's legislature to establish a drug and cosmetic agency along the lines of the federal Food and Drug Administration. He has pointed out that such an agency would be in the public interest because there is no present method of preventing manufacture of fake or illegal drugs unless such products are involved in interstate commerce. —*Drug Trade News, Jan. 5, 1953.*

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AVMA Convention in Toronto Expected to Break Attendance Record

When the American Veterinary Medical Association meets in Toronto, Ontario, Canada, for the 90th annual meeting, July 20-23, 1953, there is likely to be the largest turn-out of veterinarians ever assembled in North America. Toronto's location places it within 500 airline miles of the New England States, New York and the Middle Atlantic States, several of the South Central and East Central states and a good section of the Midwest, to say nothing of nearby Canadian provinces where a large proportion of the Dominion's veterinarians are located.

Over 60 million people live within a day's journey of this popular convention city whose name, appropriately, is an Indian word meaning "meeting place." A large segment of the veterinary population of the two countries also resides within this area. This will be the fourth time in AVMA history that an annual meeting will be held outside the United States. Three others met in Canada: Ottawa in 1903; Toronto in 1911, and Montreal in 1923.

The Royal York, the largest and finest convention hotel in North America, will house most of the convention functions, meetings, and exhibits and will also accommodate its share of registrants. About a dozen additional first-class hotels and some fine motor hotels (motels) also insure ample and satisfactory housing of convention-goers.

The AVMA and the Committee on Local Arrangements have arranged with the Toronto Convention and Tourist Association to operate a Housing Bureau which will handle and confirm all reservation requests. Information about hotels and rates, together with a reservation blank may be found in the advertising section of the *AVMA Journal* each month. Persons who do not have copies may obtain a reservation blank by writing to the AVMA, 600 S. Michigan Ave., Chicago 5, Ill.

The prospects of a record registration make it advisable to obtain reservations early. The Housing Bureau insures orderly and satisfactory handling of reservations.

Canada's Vacation Attractions

In addition to visiting "another country" with somewhat different customs even though such a close neighbor, veterinarians and their families from the United States will undoubtedly take advantage of the other attractions which Ontario Province and other parts of Canada offer vacation-wise. The lake and mountain regions are especially fine and offer fine fishing and scenery. An hour's drive northward from Toronto brings one to wooded Lake Simcoe, with the famed Muskoka Lakes beyond. Farther off to the northwest is island-studded Georgian Bay, a forested area of Lake Huron, only a half-day's drive from Toronto.

For the wives there is also the attraction of Toronto as a shopping place and an excellent opportunity to buy such things as special quality woolens and china at very reasonable prices. Toronto is called "The Trading Post of Canada" which denotes its outstanding position as a business and banking center and the principal manufacturing and supply source for all kinds of goods and products.

The Scientific Program

The Committee on Program (Section Officers) has developed and practically completed one of the best programs for the six sections ever offered. There will be outstanding papers and discussions on subjects in general practice, research, small animals, poultry, surgery and obstetrics, and public health.

Television demonstrations will again be a feature of some of the section meetings.

Special Entertainment Features

This 90th AVMA meeting coincides with the "Coronation Year" festivities which take place this year throughout the British Empire. The Committee on Local Arrangements plans to capitalize on the color and atmosphere which the Dominion in general and Toronto in particular offer to visitors. The general entertainment program and the special events for women are being planned with this in mind.

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Daniel Bergsma, M.D., in presenting before an annual meeting of the American Public Health Association the subject of The Veterinarian's Responsibility in Civil Defense, summarizes his remarks as follows: "The veterinarian, as a citizen and as a member of a learned profession, is strategically associated with several important civil defense problems. These include cooperative efforts to assure adequate high protein food sources in times of national distress, safeguarding human beings from animal diseases, cooperating with epidemiological and emergency general sanitation problems, and rendering invaluable services to help care for the thousands who may be injured."

High Levels of Silicate and Vitamin D Favor Calculi Formation

Results of studies initiated at Beltsville, Md., in 1950 leave no doubt that, under the conditions of the experiments, high amounts of vitamin D and of silicate, either alone or together, favor the precipitation of minerals into granules in the urinary tract of fattening wether lambs.

The object of the studies is to determine the basic underlying dietary causes of urinary calculi in sheep as well as cattle, especially with regard to the use of sorghum crops in the ration. The occurrence of calculi, which consists, in large measure, of magnesium phosphates, has constituted in some areas of the West and Southwest a problem in fattening steers on diets consisting principally of sorghum products and cottonseed meal. Such rations have a high content of magnesium and a low content of calcium. Considerable attention has been given to the effect of varying the calcium, phosphorus, and magnesium content of these diets by means of mineral supplements. The results obtained with any one intake of calcium, phosphorus, and magnesium have varied rather widely from year to year. Observations on the occurrence of calculi in steers and in wethers and experiments with rats have indicated that the amounts of silica and of vitamin D in the feed influence calculi formation.—*Rept. Chief of the BAI, 1952.*

Dr. Henry E. Moskey, UP '20, chief of the Federal Drug Administration, Veterinary Section, was recently cited with others for completing 40 years in government service.—*Drug Trade News, Jan. 5, 1953.*

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Secretary of Agriculture Ezra Taft Benson has repeated the statement previously made by him favoring the removal of OPS controls and regulations.

Dr. T. A. Sigler Honored

In commemoration of his 33rd appearance on the annual meeting program of the Mississippi Veterinary Medical Association, Dr. T. A. Sigler, practitioner, Greencastle, Ind., was honored by that group with the presentation of a portrait of himself.

Doctor Sigler has been in practice over 50 years and active in association work. He has been an honorary member of the Mississippi group for some year.

Presentation was made during the sessions of the Tri-State Veterinary Medical Association which includes the Associations in Arkansas, Tennessee, and Mississippi. Dr. W. L. Gates, Clarksdale, Miss., made the presentation speech.

The portrait was painted in oil by Mrs. Marion Chamberlin, Memphis, Tenn.

The presentation of a beautiful oil painting to Dr. T. A. Sigler, Greencastle, Ind., highlighted Banquet Night activities at Memphis on Jan. 12, 1953. (l. to r.) Dr. J. V. Duckworth, Meridian, Miss.; Dr. W. L. Gates, Clarksdale, Miss.; Dr. T. A. Sigler, Greencastle, Ind.; and Mrs. Marion Chamberlin, Memphis, Tenn., artist.

General McCallam Retires From Post as Head of Veterinary Corps

Brig. Gen. James A. McCallam, V.C., Chief, Veterinary Division, Office of the Army Surgeon General was the guest of honor on January 30 when ranking officers of the Office of the Surgeon General, members of the Veterinary Division and friends gathered to present

Brig. Gen. James A. McCallam

to him their best wishes on his retirement the following day from his post as chief of the Division and head of the Veterinary Corps, U. S. Army.

With his retirement, General McCallam brings to a close a period of service that spanned approximately the entire time the Veterinary Corps has been in existence. Joining the Army in July 1917, about a year after the Veterinary Corps was established, General McCallam has seen it grow from a small body of personnel, charged primarily with providing veterinary service for animals used by the Army, into an organization on which has been laid major responsibility for safeguarding the health of Army troops from food-borne disease.

During his Army career, General McCallam has held posts as Veterinarian, 9th Mounted Engineer Battalion, 15 Cavalry Division (1917-18); Regimental Veterinarian, 4th and 12th Cavalry Regiments (1918-20); Division Veterinarian, Hawaiian Division (1920-24); Headquarters Veterinarian, Remount Purchasing and Breeding Headquarters, Central Zone and Instructor and Officer in Charge, Medical Department Reserve, Kansas City, Mo. (1926-31); Station Veterinarian and Instructor, The Engineer School, Fort Belvoir, Va. (1931-37); Instructor, The Field Artillery School and Station Veterinarian, Fort Sill, Okla. (1937-41); Corps Area Veterinarian, Headquarters Eighth Corps Area, Fort Sam Houston, Tex. (1941-42); and Army Veterinarian and Executive Officer, Medical Section, Headquarters Sixth Army (Australia, New Guinea, the Philippines and Japan, (1943-45). It was from this last command that he joined the Veterinary Division in Washington, D. C., in January 1946.

A native of Philadelphia, General McCallam received his Doctor of Veterinary Medicine in 1917 at the University of Pennsylvania. He also attended the Army Veterinary School, Washington, D. C. and took a course at the Medical Field Service School, Carlisle, Pa., graduating with honors in 1925.

General McCallam has been awarded the Legion of Merit and Bronze Star Medals for his service with the Sixth Army in the Southwest Pacific and wears the Commendation Ribbon. He was promoted to the rank of Brigadier General on January 24, 1948.

Recently General McCallam was honored by election to the presidency of the American Veterinary Medical Association for the year 1953-54. Upon his retirement he also will serve as Washington representative of the Association. Other professional organizations in which he holds membership are the District of Columbia Veterinary Medical Association, the American Public Health Association, and the Association of Military Surgeons.

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"Sore muzzle" in ewes is spreading to new areas in Texas. Affected sheep lose 20% of body weight during the acute stages of the infection which lasts for ten to 14 days. They regain lost weight in about the same period.

Mortality is low, ranging in most instances from 1 to 2% of those affected. A more virulent type is reported in California.

No treatment program has proved effective. Prevention of screwworm infestation is an important and difficult problem. This disease is thought to be identical with the condition described as blue tongue, reported to occur only in South Africa. Mortality figures differ markedly, however, and serious losses, ranging as high as 30%, are reported due to blue tongue infection.

Serum agglutination studies are under way. —*W. T. Hardy, D.V.M.*

Insecticide Injections Tested as Control of Livestock Pests

The treatment of livestock with injections of insecticides to control common external parasites, such as flies, mosquitoes, and lice, is being tested, according to Mr. A. W. Lindquist, entomologist. The statement was made in an address presented at the American Association of Economic Entomologists meeting in Philadelphia.

He emphasized that investigations are exploratory and that the research has not advanced far enough to consider practical use of the chemicals tested. If the studies continue to show promise, a search will be made for effective and safe materials.

Describing the results of preliminary investigations, Mr. Lindquist said the chemical lindane, alone of five insecticides tested, was effective against deerflies and mosquitoes when injected under the skin of cattle. Once injected, the lindane is carried through the bloodstream to all parts of the animal's body, so that a fly or mosquito that pierces the animal's skin in an attempt to feed, is dosed with the insecticide. Lindquist said that the other four insecticides used in these early tests — aldrin, allethrin, dieldrin, and heptachlor — had been effective against a variety of external parasites when injected into mice, but were not satisfactory as a cattle injection.

Lindane injections provided good control of deerflies feeding on cattle within eight hours after injection and continued to kill a high percentage of the pests for as long as two weeks. Mosquitoes were controlled with the same degree of success on two animals, as between 60 to 70% of the mosquitoes feeding from their blood streams were killed 18 and 21 days after injection.

Lindane-injected cattle also were kept free from horn flies, although no precise data were obtained. Mr. Lindquist said that for 30 days following injection, only an occasional horn fly was observed in the five-acre field where the cattle were pastured.

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Research in nutrition and disease control in poultry has made possible increase in the egg-laying average in commercial flocks during the past decade. Statistically this increase is from 93 to 165 eggs per hen annually.

The practitioner who is equipped to render a service to the poultry industry in his community will find in the work a real challenge and profitable practice. — *James Williams, D.V.M.*

"Hog Immobilizer"

A plan to render slaughter hogs unconscious before shackling and bleeding is proving successful at the Hormel Packing Co., Austin, Minn.

The "immobilizer", as the gas chamber equipment is known, makes use of carbon dioxide gas. Animals are completely anesthetized for periods sufficient to suspend for shackling and bleeding. Aside from the humane aspects of the system, bruising of carcasses and damage to hams are minimized. In a test run on 19,000 hogs there was demonstrated a significant reduction in bloody trimmings with the new method. Stickers were able to operate accurately and efficiently.—*Livestock Conservation News, Dec. '52.*

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Brucella Vaccination Reactors

During past years, the interests of research workers have been focused on the degree of immunity to natural infection which could be developed in calves by vaccination with viable strain 19, *Brucella abortus* vaccine containing a minimum of 5,000,000,000 organisms per cc. There are no maximum limits on number of viable organisms.

The present problem is the approximately 10 or 15% of calves vaccinated at about eight months of age that may carry an agglutination titer beyond the 30 months-of-age limit. It has been observed that the vaccination reactor problem is reduced when calves are vaccinated at five months of age and in all cases before sexual maturity. This factor varies considerably in some herds and in breeds of cattle.

A survey of literature on the use of strain 19 vaccine does not reveal the effect on the agglutination titer when calves are vaccinated with a reduced number of viable organisms per cc. It is possible that a more desirable dosage of strain 19 may be found which will provide immunity against natural infection and less stimulation of agglutinins. It is an established fact that the agglutination titer is not an index of degree of immunity nor extent of infection, but only that the animal is or has been exposed to *Br. abortus* infection; all of which complicates the studies on immunity. Research on the effect of different methods of administration, *i.e.* subcutaneous, intradermal, and intracaudal, may reveal useful information on the vaccination reactor problem.

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American doctors wrote 400,000,000 prescriptions during 1952.—*S.N.L.*

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Milking Machine Operating Efficiency — Influence on Udder Disease

One of the causes of teat and udder troubles when milking machines are used, is an unequal degree of suction in the vacuum line. In general, it is agreed that if only one vacuum regulator is used it should be placed near the pump end of the line rather than at its far end. In fact, some dairymen have additional regulators along the vacuum line. There are a variety of conditions that may cause an unequal vacuum anywhere from the pump to the teat cups such as obstructions in the air hoses, leaking pulsators and mechanical defects. Sometimes the vacuum is excessive so that teat eversion, or even a mastitis flare-up may result from this factor.

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Frozen Semen Viable for Extended Periods

Reports are beginning to come in that bovine semen kept at freezing temperatures, as low as —110 F., may remain viable for a long time. In England, four-month-old frozen semen settled 75% of the cows on first service. It is hinted, though not yet conclusively demonstrated, that semen storage at extremely low temperature may possibly be the means of keeping spermatozoa viable long after the sire has expired.

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Superior Disinfectant

A Czechoslovakian disinfectant and bactericide known as movidyn is said to be commercially available in the United States. It is a stable, colloidal suspension, non-corrosive, and non-poisonous. It is claimed that one part of it in 10,000,000 parts of water will sterilize the latter to prevent the growth of algae, fungi, and molds. It is even asserted that pipes, containers, tanks, etc., that have been in contact with movidyn solution will themselves become sterilizing agents. Fruits and vegetables washed in a solution of this agent will have their surfaces sterilized so as to control spoilage. It will be interesting to observe its use in the United States.

Diagnosis of Atrophic Rhinitis

A visiting practitioner advises that when he suspects atrophic rhinitis in a herd he makes a nasal examination of the suspect by means of a human otoscope; for this purpose he calls it a rhinoscope. The hog is properly confined for the examination. It took this veterinarian a short time to acquire the necessary proficiency, but now he contends that he can make a diagnosis before there is facial distortion so that the owner can remove infected animals at an early stage of the disease. Usually those in which this comparatively early diagnosis has been made may be marketed without their owner's suffering an extensive financial loss.

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Complement Fixation Test for Leptospirosis

From the Veterinary Virus Institute, New York State Veterinary College, it is reported that a "simplified complement-fixation test has been devised recently and applied in a preliminary survey of the incidence of leptospirosis in the state of New York." Since the symptoms of the disease in cattle are not clear-cut, and as infected cattle remain spreaders of the infection by spattered urine and otherwise, an early diagnostic test is of significance. This is of importance since by clinical diagnosis the disease has been reported from such widely separated states as California, Montana, Texas, Kansas, Missouri, Illinois, Wisconsin, Georgia, and New York. The detection of carriers in herds by a reliable test is important.

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In regard to equine infectious anemia, so-called swamp fever, the 1951 Report of the Chief of the U. S. Bureau of Animal Industry states, "Blood of two former carriers that were resistant to repeated exposures to the virus was found to be noninfectious and devoid of immunizing value when injected subcutaneously in large doses into susceptible horses." Also in the same report, "The chicken red blood cell hemagglutination test indicates that this test, like other laboratory tests heretofore advocated for detection of the disease, is not dependable as a means of diagnosis."

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

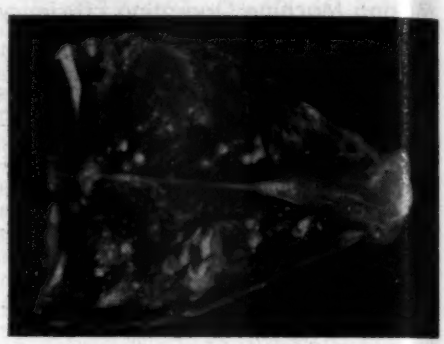
Aspergillosis

Aspergillosis (brooder pneumonia, mycotic pneumonia, pneumomycosis), is a disease caused by any one of several species of the fungal genus Aspergillus. *A. fumigatus* is the principal one. The incidence of the disease is not great, but many species of birds are susceptible. Young birds of brooder age are most affected, probably due to more constant exposure by contact with contaminated litter rather than to age susceptibility. Turkeys and pigeons appear to be more susceptible than chickens to spontaneous infection. This disease is a frequent cause of death of exotic birds and especially of penguins in zoological gardens.

The disease is encountered in two forms. In young birds, acute outbreaks occur with a high morbidity and a high mortality. In penguins, the malady usually takes on the acute form. In older chickens and turkeys, sporadic cases usually occur, but occasionally when intensive exposure results from heavily contaminated feed or litter, the acute form may develop.

Since the disease in young chicks or poults may be confused with salmonellosis and especially pullorum disease and with acute respiratory ailments such as infectious bronchitis, they must be considered in making a differential diagnosis. The symptoms include dyspnea, gasping and accelerated breathing. Listlessness, lack of appetite, and emaciation are other symptoms. In an outbreak in wild turkey poults reared in captivity, described by Durant and Tucker (*Jour. Am. Vet. Med. Assn.*, 86:781, 1935), the disease appeared at five days of age and reached a maximum mortality in 15 days. At the end of 21 days, 585 of the 700 poults had died. Hudson (*Poultry Sci.*, 26:192, 1947) reported infection in the eyes in chicks two to five weeks of age. These chicks were exposed to contaminated bagasse (shredded sugar cane refuse), and the disease in them was characterized by the formation of a yellow caseous pellet beneath the nictitating membrane, with corneal ulceration in a few instances.

The lesions seen on necropsy depend on the site of infection. In acute cases, generalized



Lung lesions seen in acute cases of aspergillosis of birds. Note miliary caseated nodules and the large irregular roseate-like lesion with center darkened by aerial hyphae, as indicated by the arrow. (From Hinshaw in Biester and Schwarte).

infection of the respiratory tract, including the air sacs, is common. Pulmonary lesions vary from miliary to pea-sized yellowish nodules in the lung tissue, or the lungs may be entirely hepatized. Often the air sacs will be filled with yellow semiliquid or caseated exudate with nodules or button-like ulcers attached to the mucous membranes. In the early stages, these ulcers appear as round, yellowish-white masses attached to the membrane. In advanced cases, a greenish mold turf may be seen over surfaces of the infected areas and in the convex depressions of the ulcers. Final diagnosis depends upon isolation and identification of the mold.

No satisfactory treatment has been found. Since the most common source of infection is contact with contaminated litter and less so with contaminated feed, careful selection of both feed and litter is essential. A search should be made to locate the source of the fungus causing outbreak, and whether litter or feed, it should be discarded. Liberal use of 0.5% copper sulfate solution as a fungicide will aid in eliminating the infection and in the prevention of further cases if the cause can be removed.

For a more detailed discussion the reader is referred to discussions by Bullis, and by Hinshaw, (Poultry Diseases, by Biester and Schwarte, ed. 3, Ames, Iowa State College Press, 1952, pp. 435 and 1109).

ABSTRACTS OF LITERATURE

Etiology of Bovine Keratitis[3]

Notwithstanding the suggestion that keratitis in cattle may be caused by a virus or rickettsial-like organism, the author presents evidence to support conclusions that this infection is due to a specific diplobacillus. This organism is classifed by Bergey as *Moraxella bovis* (*Hemophilus bovis*) which appears as rough, intermediate, and dwarf forms after prolonged culturing. The organism was isolated from 92 of 95 cattle acutely infected with keratitis.

The incubation period was established at 15 to 21 days; some animals carry the infection for one year or longer. Cattle known to have had an attack of keratitis were not susceptible to reinoculation one year following experimental infection, which suggests the possibility of the development of an immunizing agent.

Attempts to produce keratitis with *Moraxella bovis* in sheep were unsuccessful.

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Tapeworms in Calves[4]

Death losses in a herd of Jersey calves in southern Illinois were approximately one-half the calf crop (20 head) after the third year on contaminated lots and pasture. The author refers to the parasite *Monezia benedeni* and *M. expansa*. The life history involves the common grass mite as intermediate host and it is most prevalent in damp areas. Eggs developed within the mite, when eaten by calves develop into adult parasites which attach themselves to the wall of the small intestine.

Treatment recommended is 1 to 1.5 gm. lead arsenate. Sanitary management practices are recommended as best preventive measures.

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Antibiotics and Egg Production

The authors report extensive trials to determine the effect of supplementing laying rations with antibiotics at the so-called feeding level. In these trials, a quality ration containing adequate protein was fed.

Well supported conclusions were that the addition of antibiotics to the feed does not improve egg production or body weight of birds during the first year of production[5]. Neither was such supplementation of value in the prevention of specific diseases, including leukosis and blue comb.

The authors refer to experiments in which the value of B_{12} added to an all plant diet was demonstrated. Such addition appeared to improve egg production.

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Nutritional Muscular Dystrophy and Stiff Lamb Disease

The studies on vitamin E deficiency in lambs[6] revealed a similarity in clinical symptoms, yet "muscular weakness seemed to be the characteristic symptom of vitamin E deficiency, whereas muscular stiffness was the typical symptom of stiff lamb disease. This may suggest the influence of other factors in addition to the absence of tocopherols in the case of stiff lamb disease." The treatment with alphatocopherol proved effective as a preventive and curative agent in the early stages of deficiency. The value of cortisone and prostigmine was definitely limited.

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Equine Virus Abortion

Dr. E. R. Doll, Department of Animal Pathology, Kentucky Agricultural Experiment Station, reports that it has been determined from records that equine virus abortion is characterized by seasonal incidence,[7] most cases appearing in the late winter, about one month prior to parturition. Sixty-five per cent of cases observed occurred during the ninth and tenth months of pregnancy and 94% from the eighth month to completion of term.

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CLINICAL REPORTS

Postcastration Hemorrhage of Pigs Following Worming with Sodium Fluoride

L. R. BAIN,* D.V.M., Urbana, Illinois

Since the ascaricidal action of sodium fluoride in swine[1,2] was reported, this remedy has been used widely by veterinarians for worming pigs. The treatment consists of feeding a 1% sodium fluoride mixture in dry ground feed for a period of 24 hours. Sodium fluoride is also employed as an anticoagulant in blood examinations in glucose determination. According to Parker,[3] 10 mg. of thymolized sodium fluoride is effective in preventing coagulation of 10 cc. of blood.

Observations reported were made in an attempt to resolve the question presented by a clinician[4] regarding the possible unfavorable after-effect of sodium fluoride *in vivo* on blood coagulation when administered as an ascaricide in swine. He reported the death of 27 of 28 55-lb. boar pigs from hemorrhage within 12 hours after castration. Rations were free from moldy sweet clover or other known constituents that might contribute to spontaneous hemorrhage. The mortality in the animals mentioned above occurred following castration, although a period of seven days had elapsed after worming with 1% sodium fluoride. In support of the possible relation of sodium fluoride to surgical hemorrhage, a group of untreated pigs on the same premises was castrated at the same time and no losses occurred.

In a review of the literature no evidence suggesting sodium fluoride as a possible causative factor in the losses mentioned above could be found. The high mortality from surgical hemorrhage following castration in this herd prompted critical observation to note if experimental sodium fluoride therapy for ascarids might produce fatal hemorrhage following surgery.

In the observation described, 28 boar pigs weighing 24 to 60 lb. each were divided into four groups of seven pigs each. Groups 1 and 3 were fed 1% sodium fluoride in ground feed for 24 hours on July 29, 1952 and on August 1, 1952. These 14 treated pigs consumed a total of 100 lb. of feed containing 1% sodium fluoride in the two feeding periods or an average of 3½ lb. per pig for each treatment. Groups 2 and 4 received the same feed without sodium fluoride. Three days following the second feeding of the treated feed the 14 pigs in pens 1 and 2 were castrated. Six days after the last feeding of sodium fluoride the 14 pigs in pens 3 and 4 were castrated. No excessive hemorrhage occurred from the castration wounds and no deaths occurred in any of the castrated pigs.

Summary

In clinical observations reported above no evidence was secured to suggest that 1% sodium fluoride in dry ground feed for 24 hours and repeated in three days resulted in excessive hemorrhage or death in pigs castrated three and six days subsequent to the last feeding of sodium fluoride.

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*Department of Veterinary Clinical Medicine, College of Veterinary Medicine, University of Illinois, Urbana.

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Pigeons as a Source of the Turkey Sinusitis Agent

R. W. WINTERFIELD,* D.V.M., St. Louis, Missouri

Pigeons are frequently observed on poultry ranges. Their presence and the fact that they often eat and drink from poultry feeders and waterers has focused attention on their role in the transmission of some infectious diseases.

The following case report concerns the isolation of the turkey sinusitis and chronic respiratory disease agent from pigeons.

History

A squab producer with 300 pairs of breeders was experiencing a respiratory disease problem in his pigeon loft. Troubles commenced a

*Ralston Purina Company, Animal Pathology Division, St. Louis, Mo.

short time after 40 breeder replacements were purchased from a grower whose birds had been confined in a pen adjacent to chickens. Respiratory symptoms developed in these purchased birds and spread slowly through the other pens. Mortalities were appreciably higher in the squabs. A chronic, debilitating course was experienced in this outbreak.

Laboratory Findings

Clinical examination of three typically affected birds revealed a nasal discharge and respiratory rales. Marked conjunctivitis was present in one specimen. On autopsy, thickened, caseated air sacs were present in two and all three had a severe tracheitis. Routine bacteriological examinations were negative. Hemagglutination-inhibition tests for Newcastle disease were negative. Affected respiratory tissues and tracheal exudate were macerated, suspended in tryptose broth and injected intrasinusoidally into four, ten-week-old turkey poults. All birds developed a typical sinusitis in six to ten days.

Sinus fluid aspirated from these poults was found to be bacteriologically sterile, and then diluted 1:4 with tryptose broth. Seven-day-old embryonating chicken eggs were inoculated via yolk sac with this material. The agent was carried through four serial passages in eggs and showed a marked lethal effect for the embryos as early as the first passage. Embryonic deaths usually occurred by the end of the seventh day, and subcutaneous hemorrhages were observed in some mortalities. Most strains of turkey sinusitis and chronic respiratory disease agent isolated in our laboratory have not shown this early embryonic mortality pattern.

Amnioallantoic fluid was harvested and used as inoculum in experimentally producing typical infectious sinusitis in turkeys and chronic respiratory disease in chickens. Negative results were observed in weanling mice inoculations.

Four healthy squabs were inoculated intranasally. Ten to 20 days postinoculation all four pigeons exhibited respiratory rales and three of them had a severe coryza and conjunctivitis. They were sacrificed for autopsy and severe tracheitis was noted in three.

Comments

Since infectious sinusitis and chronic respiratory disease are very widespread and of great economic importance to the poultryman, one should not overlook any of the ways in which the causative agent can be spread. The pigeon may be considered as one possible means of transmission.

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Unilateral Ureterectasia and Pyosis

ROBERT E. SWOPE,* V.M.D.,
Philadelphia, Pennsylvania

A male, Holstein calf, four months of age was presented for postmortem examination following a chronic illness of two months which was manifested by anorexia, progressive emaciation and moderate diarrhea. This animal was one of twin calves whose dam had

been repeatedly affected, during her gestation period, with suppurative lesions of the subcutaneous tissue, localized particularly in the region of the hocks. Several of these suppurative processes had required surgical drainage with the removal of large quantities of purulent material. Late in pregnancy, the cow became increasingly weakened and debilitated and parturition undoubtedly hastened her death, on the second day following parturition.

The autopsy examination of the calf revealed no pathological changes in the circulatory, respiratory or digestive organs. However, upon opening the abdominal cavity, a soft, inflamed mass was observed occupying a large portion of the abdominal cavity. The great size of this mass (15" x 15") caused compression and dislocation of other abdominal organs. (See illustration.) The enlargement consisted of extreme dilatation of the right ureter which occupied the entire ventral portion of the abdominal cavity. This resulted in compression of the paunch to a left posterior position with the small intestine assuming a position anterior and to the right of the liver in juxtaposition with the diaphragm. The serosa of the affected ureter was markedly engorged and adhered to left ureter, the vertex

*Animal Pathology Laboratory, The Pennsylvania State College.

of the bladder and ventral peritoneum. The abscess cavity contained 20 liters of tenacious, creamy yellow, odorless, purulent material which was adherent to the diffuse hemorrhagic areas of the ureteral mucosa. Both proximal and distal to the ectatic portion, numerous ureteroliths were present, apparently resulting in complete stenosis of the ureter since no purulent material was found outside the lumen of the abscess proper. Although the right kidney was somewhat atrophied, no evidence of nephritis or hydronephrosis was observed and it is probable that this kidney was non-functional.

It is assumed that the unusual, fatal, pathological change described in this calf was directly attributable to a congenital infection as a result of a septicemia present in the cow during the development of the calf.

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Treatment of Anomalies of the Eye in South American Chinchilla

PAUL M. NEWBERNE, D.V.M., MS,
Columbus, Georgia

The eye of the chinchilla appears to have a remarkable ability to recover from infection and injury. However, some forms of eye conditions left untreated or not treated properly may result in permanent loss of sight in the affected eye or in some cases lead to fatal termination.

Keratitis and related conditions are common in the chinchilla and very often resist treatment with the usual medicants, making it desirable to find an agent more efficacious in this specie. Evaluation of a preparation named neosone® was made on routine cases presented to this laboratory for treatment as well as on cases at a number of other local ranches. Neosone contains cortisone and neomycin in a suitable base. The preparation was used on each patient with an eye affliction in which it might be indicated, with no attempt to equalize the number of cases in each group. Control groups were not set up.

Results

Application was made twice daily. Improvement was evident in from one to three days in those cases responding. Two cases of keratoconjunctivitis and one case of corneal ulcers healed that had not responded to prolonged treatment with other agents. Least response was in cases of chronic conjunctivitis that had been under treatment for a period of time but had not yielded to other medications.

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Results Following Treatment With Neosone

Condition	No. Cases	Improved	Healed	No Change	Remarks
Keratoconjunctivitis	18	3	14	0	1 died with gastroenteritis
*Corneal ulcers	7	1	5	0	1 progressed to leukoma with loss of eye
Corneal opacity	7	1	4	2	
Pannus	3	1	2	0	
Keratocele	2	-	2	0	
Conjunctivitis	22	3	15	3	1 killed by mate
Corneal foreign bodies and wounds	19	-	19	-	2 progressed to corneal ulcers which later healed

*Sterile milk injections were used in conjunction with local applications of neosone.

Summary

1. A number of eye conditions in the chinchilla were successfully treated with neosone, yielding more rapidly and in a greater percentage than with other treatments.

2. All cases responding showed early improvement with healing in three to 14 days.

3. Results were satisfactory in forms of interstitial keratitis which are usually resistant to treatment with other agents.

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Removing the Vocal Cords of Fowl

Dr. A. J. Durant's article on removing vocal cords of fowl (*Jour. Am. Vet. Med Assn.*, 122:14, 1953) rated space in Notes of the Week (Newsweek, Jan. 26, 1953) as a "first" in new technics. Durant considers the operation for removal of the vocal cords a major one which must be performed under complete anesthesia to be successful. This may be produced by intravenous injection of pentobarbital sodium using approximately 1 cc. per 5 lb. of body weight. The operation which has been successfully performed on male chickens and turkeys consists in destruction by electric cautery of the anterior surface of the prismatic bone of the syrinx (osteum syringium). For details, the reader is referred to the original article . It is hoped that Doctor Durant will extend his surgical efforts to develop technics for other male birds and especially for the peafowl and goose.

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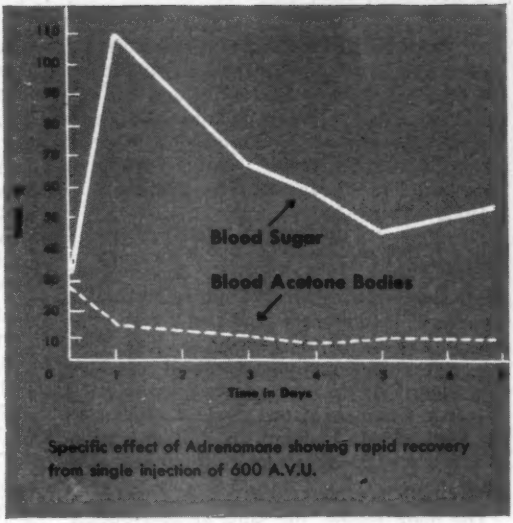

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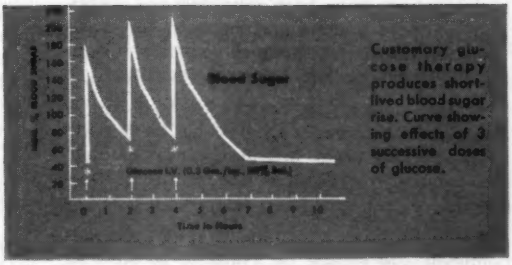

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BOOK REVIEWS

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CANINE SURGERY. A Text and Reference. The work of 29 American authors. Edited by *H. Preston Hoskins* and *J. V. Lacroix*. Third edition enlarged and revised, 731 pages, 537 illustrations, buckram binding. American Veterinary Publications, Inc., Evanston, Ill., publishers, 1952.—Price $15.

In a review of an earlier edition (Vet. Med., 44:318 [July], 1949), Canine Surgery was commended as a useful text and reference for veterinary practitioners and veterinary students. Test of its acceptance is in the fact that in less than four years demand was such that extensive revision was undertaken to bring text material up to date. New material also has been added, including illustrations, many of which are drawings replacing photographic illustrations.

The book follows the same general outline of the earlier edition. Chapters on Healing and Repair, Surgical Principles, and Sutures and Ligatures have been rewritten and amplified to improve their usefulness in the classroom as well as for reference purposes. Chapter 29, Fractures, also has been rewritten.

In reference to the chapter on fractures, a field in which so much progress has been made in most recent years, text material is complete and comprehensive. It is also profusely illustrated.

Canine Surgery is certain to draw favorable comment and should be available to all who desire to improve their proficiency in the surgical arts.

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MANUAL OF VETERINARY CLINICAL PATHOLOGY, by *David L. Coffin*, V.M.D., Pathologist, The Angell Memorial Animal Hospital, Boston, Mass. Third edition, 322 pages, 73 illustrations. Comstock Publishing Associates, Ithaca, New York, publishers, 1953. — Price $5.50.

As its name implies, this book deals with clinical pathology in such manner as to be of most value to the veterinary practitioner. It is neither elementary nor exhaustive in a pathological sense; it is concise and instructive, a manual that will assist in establishing a firm diagnosis.

Progress in veterinary medicine has required supplementation of laboratory medicine. Examination of specimens has rewarded the effort by indicating disease processes. Proper application and interpretation of findings have assisted in making applied therapeutics more productive.

The scope of this edition has been broadened. A new chapter entitled Diagnostic Interpretation in Clinical Chemistry has been included. Additions have been made to other chapters. To this reviewer, the chapter on Interpretations of Hematologic Findings is worth the price asked for the book.

The book is widely used in veterinary colleges and will, no doubt, continue to "fill in" as a source of practical information in this fast-developing field.

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A filmstrip (35mm.), Epizootiology of Anthrax has recently been released by the Audio-Visual Production Services of the Communicable Disease Center, Public Health Service. The film, the purpose of which is to serve as an aid in teaching the recognition, diagnosis, and control of anthrax, is available on loan for the training of veterinarians, practicing physicians, instructors, and students in veterinary and medical schools, and public health personnel interested in anthrax. It will be placed on sale in the near future, at which time it can be purchased from United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

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